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Rainbow Trout Experimental Stocking Program: Rainbow Trout and Brook Trout Field Comparisons

By James C. Pellerin

Caring for Maine's Outdoor Future

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SUMMARY

- This study evaluated the relative field performance of Eagle Lake strain rainbow trout and Maine Hatchery strain brook trout as part of a larger project to examine the feasibility and value of initiating a rainbow trout stocking program in Maine. Study objectives were: (1) to compare angler catch/harvest rates and examine whether the two trout species differ in their seasonal availability to the angler; (2) to evaluate relative size quality and growth, (3) to assess survival and carry-over potential; (4) to compare trout utilization of the food chain, and (5) to examine trout performance in waters with marginal summer water quality under different levels of competition/predation.

- Mean catch rates (all trout/hr) for individual waters were numerically higher for rainbow trout on three out of the four waters, but were significantly higher only for Overset Pond (Wilcoxon Rank Sum Test, 1-tailed, $p \leq 0.05$). Pooling data across all waters yielded a significantly higher catch rate for rainbow trout (Wilcoxon Rank Sum Test, 1-tailed, $p=0.0045$), but the numerical difference was relatively small (1.2 times higher). The data suggest that mean catch rates for the entire open water season are fairly similar between the two species.

- Across all waters, legal-sized rainbow trout were caught and harvested at rates 2.5 and 3.8 times greater than those of brook trout, (Wilcoxon Rank Sum Test, 1-tailed, $p<0.0001$). These results are not surprising considering the slightly greater lengths at stocking, and the higher percentages of legal-sized fish at the time of stocking for rainbow trout.

- A review of catch rates (all trout/hour) by early, mid, and late season indicated that brook trout typically provided slightly better early season angling opportunities, whereas rainbow trout provided better mid to late season fishing. Although numerically higher when pooled across all waters, the mean catch rates for brook trout during the early portion of the season were not significantly greater than rainbow trout (Wilcoxon Rank Sum Test, 1-tailed, $p \leq 0.05$). On the other hand, the catch rates of pooled data shows that rainbow trout provided catch rates that were 2.6 to 2.7 times higher than brook trout during the mid to late season period (Wilcoxon Rank Sum Test, 1-tailed, $p \leq 0.05$).

- Brook trout produced fisheries of lower size quality than rainbow trout. Mean lengths of brook trout ranged from 10.8 to 12.7 inches depending on the water, whereas rainbow trout varied from 12.5-15.5 inches. Pooling data across all ponds yielded a mean length of 11.2 and 14.6 inches for brook trout and rainbow trout, respectively. Mean weights varied from 0.4 to 0.8 pounds and 0.6 to 1.3 pounds for brook trout and rainbow trout, respectively. The mean weight across all study waters was 0.62 pounds for brook trout and 1.1 pounds for rainbow trout. Mean length and weights were significantly greater for rainbow trout on all waters combined, and on all individual waters with adequate sample sizes (Two-sample T-test, $p \leq 0.05$).

- Rainbow trout exhibited better growth rates than brook trout: the mean incremental growth rate across all waters was 0.30 and 0.45 inches/month for brook trout and rainbow trout, respectively; and 0.033 pounds/month for brook trout and 0.061 pounds/month for rainbow trout. Growth rates for length and weight were significantly higher for rainbow trout for all waters combined (Wilcoxon Rank Sum Test, 1-tailed, p=0.0000).

- Rainbow trout holdover to older ages was superior to brook trout on three out of the four study ponds. Across all waters, rainbow trout older than I+ comprised 55.1% of the sample by species compared to only 10.0% for brook trout. Survival estimates for brook trout and rainbow trout across all waters was 0.14 and 0.38, respectively.

- Fall diets of brook trout and rainbow trout were very similar, and Eagle Lake strain rainbow trout did not appear to utilize larger, non-insect type food items (i.e. fish, mollusks, crayfish) anymore than brook trout.

- Although our sample size was limited to four ponds, survival and growth data suggests rainbow trout were more tolerant of competition and/or predation than brook trout. Interestingly, it also appears that poor to marginal summer water quality conditions may be more limiting to rainbow trout performance than heavy competition.

- Age composition data from Overset Pond indicates that interspecific competition may have occurred between rainbow trout and brook trout. However, regulation changes may also have contributed to the observed changes in the brook trout population structure at Overset Pond.

KEY WORDS: RBT, BKT, ANGLER SURVEY, AGE & GROWTH, SURVIVAL, SIZE AT AGE, FOOD HABITS, COMPETITION

INTRODUCTION

Although the original distribution of the rainbow trout (*Oncorhynchus mykiss*) was largely limited to the Northwestern United States and Canada, they have been widely introduced throughout North America and in various countries around the world (Scott and Crossman 1973). Their excellent sporting qualities have made them one of the most popular trout species in the United States. Their popularity among anglers, the relative ease of culture in a hatchery environment, and the availability of various strains for different fishery management programs have all contributed to their widespread use in state and federal stocking programs. Eicher (1946), Swink (1983), and Hartzler (1988) all reported that rainbow trout comprise a significant component of many state salmonid-stocking programs. A more recent survey revealed 36 out of 37 responding states had rainbow trout stocking programs, and every state in the Northeastern U.S., other than Maine, had a stocking program for rainbow trout (Pellerin 2000a).

Anglers have often queried the Maine Department of Inland Fisheries and Wildlife (MDIFW) about initiating a rainbow trout stocking program. Rainbow trout were historically stocked in Maine until the early 1940s by the federal hatchery system, and an experimental stocking program was conducted by MDIFW from 1968 to 1979. The experimental stocking project initially compared rainbow trout and brook trout (*Salvelinus fontinalis*) performance in terms of growth, holdover, summer fishing opportunity, and resistance to competition. Although rainbow trout performed reasonably well in some waters, results were mixed and there was no overwhelming evidence they performed substantially better than brook trout (DeSandre 1974). Rainbow trout growth data from these earlier trials suggested they might perform well on small to moderate sized lakes where landlocked salmon were performing poorly due to a lack of smelt for forage. Between 1974 and 1978, rainbow trout performance was re-examined on 15 different lakes ranging from 60-1,220 acres in size where forage opportunities for salmon were limited. Creel surveys on 6 waters demonstrated that rainbow trout grew well, but provided low angler returns (winter). The Department discontinued the rainbow trout project in 1979 for several reasons including: (1) difficulties associated with acquiring disease-free egg sources; (2) the danger of accidental mixing of rainbow trout with other coldwater species in the hatchery system leading to an introduction in drainages where they might compete with native salmonids; and (3) failure to meet some expectations (i.e., there was a lack of natural reproduction and limited holdover in streams, and low winter returns).

In the fall of 1997, the Fishery Division established a committee comprised of biologists and hatchery staff to revisit the prospect of establishing a rainbow trout stocking program. After deliberation, the committee and Department heads decided to move forward with a limited, experimental program to re-evaluate the relative performance of rainbow trout, brook trout, and brown trout (*Salmo trutta*). A new evaluation was deemed necessary for several reasons including: comparison to a different species (brown trout), changes in expectations, changes in stocking practices, and to address deficiencies associated with the earlier comparative rainbow-brook trout studies. Our intent was to determine whether rainbow trout would provide fishery managers with an additional option for improving fishing opportunities. The study was conducted over a 6-year period in a variety of Maine waters and included three components: (1) field performance comparisons of browns and rainbow trout, (2) field performance comparisons of brook trout and rainbow trout, and (3) hatchery performance comparisons among all three trout species.

In the remainder of this paper the author discusses the field performance comparisons of brook trout and rainbow trout. Many studies have compared the field performance of these two species, but none have compared these same two trout strains or their relative performance in Maine waters. Although DeSandre's (1974) research was similar to the current project, the strains employed were different. In addition, we have attempted to address some of the problems associated with his earlier work (i.e. strain variations), as well as changes in stocking and management practices (switch from fall fingerling to yearling trout stockings in marginal waters). Study objectives for this project were: (1) to compare angler catch/harvest rates and examine whether the two trout species differ in their seasonal availability to the angler; (2) to evaluate relative size quality and growth, (3) to assess survival and carry-over potential; (4) to compare their feeding habits, and (5) to examine trout performance in waters with marginal summer water quality under different levels of interspecific competition/predation. Despite the passage of over three decades, the study objectives and perceived management benefits of rainbow trout are nearly identical to those identified by DeSandre.

STUDY AREAS

Brook trout and rainbow trout comparisons were conducted on four ponds located in Maine Fishery Management Region A. The waters in the study represent a range of characteristics for small trout ponds in terms of morphometry, habitat types, water quality, and fish communities. A description of each of the study waters is presented below. Stream comparisons were also considered, but eliminated from the study for several reasons including: fiscal and staff constraints; rainbow trout were being compared to brown trout in marginally suited large to medium size stream habitats; and it was projected that rainbow trout would more likely be used to replace brook trout in marginal ponds where brook trout management has been unsuccessful.

Long Pond

Long Pond is located in the town of Denmark in Oxford County, Maine. The pond is 48 acres in size with a mean and maximum depth of 8 and 19 feet, respectively. Long Pond is essentially homothermous; however, springs located in shallow water within one of the two basins provide a summer refuge for trout. Shoreline areas have sandy substrates and aquatic weed growth is limited. Annual stockings are required to maintain a trout fishery due to a lack of spawning and nursery habitat, and Long Pond has historically been stocked with 600-800 spring yearling brook trout. Brook trout have demonstrated some limited carry-over potential, and the pond produces a few 15-16 inch brook trout each year. BUL, BKF, GLS, and SLT (see Appendix A) are also present within the lake and provide some competition, but summer water quality is suspected as the major factor limiting brook trout performance. This water provided habitat to evaluate rainbow trout in a small pond with moderate competition, no fish predators, and poor summer water quality.

Long Pond is closed during the winter season and the open water season is regulated as follows: minimum length limit 12 inches with a 2 fish daily bag limit; opens May 15; S-2 & S-3 (lake and tributaries closed to the taking of smelt); S-6 (artificial lures only); and S-23 (extended fishing season, open until Oct. 31, catch-and-release, artificial lures only).

Jaybird

Jaybird Pond is located in the towns of Hiram and Porter in Oxford County, Maine. The pond is 14 acres in size with mean and maximum depths of 9 and 21 feet, respectively. This is a small, productive pond with two separate basins. Shallow shoreline areas exhibit heavy weed growth and the substrate is predominantly mud/muck. Jaybird pond thermally stratifies during the summer and an oxygen deficiency (< 5.0 ppm) develops below 13' feet. However, the slightly larger basin maintains a limited band of cool, oxygenated water suitable for brook trout. The large basin is approximately 8 acres in size, limiting the volume of suitable summer trout habitat. Spawning and nursery habitat is limited and annual stockings are required to maintain a trout fishery. Prior to recent studies, this water was routinely stocked with 400 spring yearling and 700 fall fingerling brook trout. Other fish species present include: BUL, WHS, PKS, WHS, and GLS. Brook trout have demonstrated relatively poor growth and limited carry-over, which is likely due to competition and marginal water quality. This water allowed us an opportunity to evaluate both trout species in a small, productive pond with moderate competition, limited predation by large predatory fish, and marginal summer water quality.

This water is closed during the winter season and the open water season is regulated as follows: minimum length limit 12 inches with a 2 fish daily bag limit; S-6 (artificial lures only); and S-23 (extended fishing season, open until Oct. 31, catch-and-release, artificial lures only).

Overset Pond

Overset Pond is located in the town of Greenwood in Oxford County, Maine. Overset Pond is a small mountain pond with a surface area of 22 acres. Mean and maximum depths are 13 and 42 feet, respectively. The pond thermally stratifies each summer and an oxygen deficiency (< 5.0 ppm) develops between 15-20 feet in depth. However, there is a band of cool, oxygenated water available for trout habitat. This water was chemically reclaimed with rotenone in the fall of 1998, and currently has no competing fish species. It lacks suitable spawning and nursery habitat for trout and annual stocking is required to maintain the fishery. Prior to reclamation, the pond was stocked with 150 spring yearling brook trout and 75 fall yearling brown trout. Brook trout exhibited poor growth and no carry-over, whereas brown trout demonstrated good growth and survival to older ages with fish up to four pounds. Brown trout stockings were discontinued after reclamation, and post treatment sampling of stocked brook trout demonstrated dramatic improvements in growth and survival to older age classes without the presence of competing species. Overset Pond presented an opportunity to examine the performance of rainbow trout and brook trout in a water with good summer water quality, and no competition. Four-wheeled drive access through a gated forestry road (key available to the public) results in relatively light use.

The pond is closed to ice fishing and open water regulations are as follows: fly casting and fly trolling only; minimum length limit 12 inches with a 2 fish daily bag limit; S-1 and S-3 (pond and tributaries closed to the taking of smelt; closed to taking of live bait, and S-23 (extended fishing season, open until Oct. 31, catch-and-release, artificial lures only).

Lily Pond

Lily Pond is located in the town of New Gloucester in Cumberland County, Maine. This is a small, productive pond with a boggy shoreline. The pond is 24 acres with mean and maximum depths of 12 and 23 feet, respectively. Lily pond stratifies during the summer months and an oxygen deficiency (< 5.0 ppm) develops below 13 feet; however, a small band of cool water with sufficient oxygen exists for trout management. In addition, anecdotal reports from anglers suggest the pond may have several springs, which provide additional summer refugia. This water lacks suitable spawning and nursery habitat for trout and annual stocking is required to maintain the fishery. Prior to the study, Lily Pond was typically stocked with 400 spring yearling, 500 fall fingerling, and 25 fall yearling brook trout. In addition, this water commonly receives stockings of unscheduled fish. Historically, this pond produced some quality sized holdover brook trout, but illegal introductions of largemouth bass and black crappie severely impacted the trout fishery. Brook trout are currently providing a put and take fishery with little evidence of carry-over beyond age I+; heavy competition from competing species and possibly predation by LMB limits their performance. This water allowed us an opportunity to evaluate rainbow trout in a small, productive pond with heavy competition, possible fish predation, and fair summer water quality. Other fish species present include: LMB, PKL, GLS, WHS, BLC, BUL, EEL, and PKS.

This water is closed during the winter season and open water regulations are as follows: minimum length limit 12 inches with a 2 fish daily bag limit; S-4 (no live fish as bait), S-13 (no size or bag limits on bass), S23 (extended fishing season, open until Oct. 31, catch-and-release, artificial lures only); and no motorboats allowed.

METHODS

Maine Hatchery strain brook trout and Eagle Lake strain rainbow trout were propagated at the Dry Mills and Casco State Fish Hatcheries as regular production lots. Hatchery staff were instructed to alter feeding regimes as needed to attain similar mean sizes between the two species at the time of stocking to reduce size dependent differences in field performance. Beginning in 2001, all of the study waters were stocked annually with paired stockings of spring yearling brook trout and rainbow trout. Both species were stocked at the same location(s) and on the same day, and all trout were marked with identifying fin clips. The marking rotation varied to differentiate between the various age classes and the two species. Prior to stocking, hatchery staff obtained total lengths (mm) and weights (g) for 30 individual trout of each species. Hatchery length and weight data were edited to remove apparent errors; individual outliers based on extremes in k-factor were removed. Summaries of stockings histories and size data are presented in Appendices B and C.

Open water voluntary creel surveys were conducted on all study waters for a period of 6 years (2001-2006). Voluntary creel surveys were chosen, because active clerk surveys were considered an inefficient use of staff and funding for small, trout ponds with limited use. Although voluntary data has specific limitations and biases, its use to evaluate seasonal patterns in catch and harvest rates between the two species on waters with paired stockings seemed reasonable. Voluntary creel data were comprised of three data sources including voluntary box data from 2001-2006, MDIFW voluntary record book data from 2002-2006, and Trip Tracks data (an Internet-based voluntary angler logbook) from 2004-2006. Voluntary creel boxes with standard MDIFW census cards were installed at all principal access sites and periodically monitored by regional fisheries staff. All creel boxes contained signage for species identification with text/color photos and an explanation of the project (Appendix D). Voluntary record books were mailed and collected from individual anglers on an annual basis, and TripTracks data were downloaded directly from the web site at the end of each open water season. Regional staff entered voluntary box and book data, while Trip Tracks data was self entered by individual anglers. Once entered and collected, all voluntary data were compiled into a single data file and edited with standard regional editing protocols. In addition, several outliers (based on catch rates) were eliminated from the data set to remove probable errors and reduce variability. All subsequent data analyses were based on the pooled and edited data.

Study waters were sampled in four of the six study years to collect age, growth, carry-over, and diet information. The first sampling event in the fall of 2001 was primarily an attempt to determine the efficacy of various sampling techniques including gillnetting, trapnetting, boat electrofishing, and experimental angling with a particular emphasis on nonlethal sampling methods. However, gillnetting proved to be the most efficient and least biased sampling technique for this study, and all waters were therefore subsequently sampled in the fall on an every other year basis (2002, 2004, 2006). The biennial sampling approach was chosen to evaluate holdover for at least two open water seasons, and to minimize the number of work hours for the project.

Depending on the water, two or more four hundred foot, red monofilament gillnets were deployed as overnight sets. All nets were experimental (equal sized panels increasing by ½ inch increments throughout the size ranges of the net) and ranged from a stretched mesh of 1.5-2.5 inches up to 2-4 inches. Nets were typically set perpendicular to the shoreline to cover a variety of depth ranges, and were often redeployed in an attempt to meet the goal of collecting at least 15 fish of the predominant age class for each species. Despite our efforts, most waters fell short of the sample size goals, which was probably the result of low stocking rates, angler harvest, and/or natural mortality. As a result, trout data were typically pooled by water across all years for statistical analysis purposes. Data from 2001 were also included in some of the various analyses where appropriate. Length, weight, and condition data from sampling events were typically transformed (ln) to improve the normality of the data for statistical comparisons between the two species.

All fish collected during sampling events were measured to the nearest 1 mm and weighed to the nearest 5 or 10g with 1 and 2 Kg Ohaus spring scales. Sex, maturity, and marks were also recorded, and stomach samples were collected. Stomach contents were either examined on-site or preserved in isopropyl alcohol and analyzed in the laboratory at a later date. Diet items were identified to major groups (i.e. aquatic insects, terrestrial insects, fish, etc.) and to at least Order when possible. Frequency of occurrence and volumetric data were determined and recorded.

Data were managed and analyzed with a variety of computer software including SAS (SAS Institute, Inc. 1985), MS Access (Microsoft Corporation 2000), MS Excel (Microsoft Corporation 2000), and Statistix 7 (Analytical Software 2000). Standard statistical procedures were used for interspecies comparisons where appropriate at the statistical significance level of $p \leq 0.05$.

RESULTS

A summary of general voluntary creel survey statistics for the entire study period is provided by water and year(s) in Appendix D. Creel data are reported by year(s) in 3 scenarios: 2001 separately, pooled across years 2002-2006, and all years combined. Data were presented in this manner due to differential length limits in place during 2001, which might cause some erroneous conclusions, particularly when evaluating legal sized fish and harvest figures. Creel census and other data in the remainder of this section are presented in context of the specific study objectives identified for the project.

Angler Catch Rates, Harvest Rates, and Seasonal Availability

Mean catch and harvest rates of legal sized trout (≥ 12 inches) were consistently higher for rainbow trout on individual study waters (Table1). Three of the eight comparisons were not significantly different (Wilcoxon Rank Sum Test, 1-tailed, $p \leq 0.05$); two of these are likely related to small sample sizes from Long Pond. Even though the sample size for Long Pond appears to be adequate, the mean catch and harvest rates are based on only a small number of successful angling trips (Appendix E). The third insignificant comparison, Overset P – kept/hour, had a relatively low p-value ($p=0.07$). Pooling catch rate data across all waters shows that legal-sized rainbow trout were caught and harvested at rates 2.5 and 3.8 times greater than brook trout, respectively (Wilcoxon Rank Sum Test, 1-tailed, $p<0.0001$). These results are not all that surprising considering the slightly greater lengths at stocking for rainbow trout, and the higher percentages of legal-sized fish at the time of stocking (Appendices C and F). Depending on the water, rainbow trout were 0.5-0.9 inches longer than brook trout at the time of stocking, and the differences in mean lengths over the study period were significant for all waters (Two-sample T-test, $p \leq 0.05$). In addition, the percentage of legal-sized brook trout and rainbow trout at the time of stocking was 0% and 19.6% (mean of the means), respectively. Consequently, all subsequent catch rate comparisons will involve the angler catch statistic of all/hour (legals kept, legals released, and sublegals) to provide a more appropriate comparison of the two trout species.

Table 1. Summary of angler catch statistics by water and species, 2001-2006.

Catch Rate Statistic[1]	Species	Water			
		Long P	**Jaybird P**	**Overset P**	**Lily P**
Legals/Hour (SE) [2] **(N)**	BKT	0.044 (0.025) (30)	**0.088** (0.018) (188)	**0.086** (0.016) (127)	**0.081** (0.022) (228)
	RBT	0.048 (0.028) (30)	**0.174** (0.026) (188)	**0.230** (0.037) (127)	**0.234** (0.032) (228)
Kept/Hour (SE) [2] **(N)**	BKT	0.017 (0.017) (30)	**0.018** (0.007) (188)	0.036 (0.009) (127)	**0.011** (0.005) (228)
	RBT	0.022 (0.022) (30)	**0.046** (0.010) (188)	0.065 (0.012) (127)	**0.103** (0.019) (228)
All/Hour (SE) [3] **(N)**	BKT	0.106 (0.032) (40)	0.411 (0.046) (221)	0.160 (0.023) (141)	**0.211** (0.034) (266)
	RBT	0.084 (0.032) (40)	0.448 (0.044) (221)	0.223 (0.034) (141)	**0.257** (0.032) (266)
		All Waters			
Legals/Hour (SE) [2] **(N)**	BKT	**0.083** (0.011) (573)			
	RBT	**0.204** (.018) (573)			
Kept/Hour (SE) [2] **(N)**	BKT	**0.019** (0.004) (573)			
	RBT	**0.072** (0.009) (573)			
All/Hour (SE) [3] **(N)**	BKT	**0.260** (0.021) (668)			
	RBT	**0.303** (0.021) (668)			

[1]Bolded values are statistically significant ($p \leq 0.05$), and N values represent the number of parties; [2] Data includes years, 2002-2006; [3]Data includes all years, 2001-2006

Mean catch rates (all/hour) for the study period were quite variable among the different study waters, which is not unexpected given the various factors associated with each water and their fisheries (Table 1). Interestingly, stocking rates (Appendix B) appear to be strongly correlated to the catch rates presented, and likely have a strong effect on this statistic. The numerical data showed rainbow trout provided slightly higher catch rates than brook trout on three out of four study waters. Long Pond was an anomaly with a slightly better catch rate for brook trout, but again angler catch rate data for this water should be viewed with some degree of caution. Individually, only one of the waters (Overset P) exhibited a statistically significant difference in catch rates between the two species (Wilcoxon Rank Sum Test, 1-tailed, $p \leq 0.05$). However, pooling data across all waters yielded a significantly higher catch rate for rainbow trout (Wilcoxon Rank Sum Test, 1-tailed, $p=0.0045$), but the numerical difference was still relatively small (1.2 times higher).

Our next catch rate objective was to determine whether or not rainbow trout provided better seasonal availability to the angler than brook trout, particularly on waters with marginally suitable summer water quality, and/or moderate to high competition from other fish species. Mean catch rates by water and species were determined for three equal time periods (71-days) of the season as follows: early season (4/1-6/10), mid season (6/11-8/22), and late season (8/23-10/31). As expected, an examination of these periods suggest that brook trout typically provided better early season angling opportunities, whereas rainbow trout provided better fishing during mid and late season periods (Table 2). Although early season catch rates were numerically higher for brook trout on all four waters, only Lily Pond was significant (Wilcoxon Rank Sum Test, 1-tailed, $p \leq 0.05$). Three out of the four waters all showed significantly higher catch rates for rainbow trout during the mid and late season time periods (Wilcoxon Rank Sum Test, 1-tailed, $p \leq 0.05$). Again, Long Pond was the outlier due to the poor sample sizes. Even though the Wilcoxon Rank Sum Test is often used with small sample sizes ($n < 15$), it should be noted that the sample sizes for individual waters are relatively small during the late season time period. Pooling the data across all waters showed the same trend, but improves the sample sizes for each time period. The combined data showed brook trout provided numerically higher catch rates during the early season, but the results were not significant (Wilcoxon Rank Sum Test, 1-tailed, $p \leq 0.05$). Rainbow trout catch rates for pooled data were 2.6 to 2.7 times higher than brook trout, and the results were statistically significant (Wilcoxon Rank Sum Test, 1-tailed, $p \leq 0.05$).

Table 2. Summary of all trout/hour by water, time of season, and species, 2001-2006.

Water	Time of Season	All Trout/Hour (SE) (N)	
		BKT	RBT
Long P	Early	0.166 (0.053) (21)	0.135 (0.056) (21)
	Mid	0.047 (0.034) (16)	0.033 (0.023) (16)
	Late	0.000 (0.000) (0)	0.000 (0.000) (0)
Jaybird P	Early	0.441 (0.052) (173)	0.422 (0.048) (173)
	Mid	**0.322** (0.122) (39)	**0.524** (0.124) (39)
	Late	**0.221** (0.114) (9)	**0.626** (0.208) (9)
Overset P	Early	0.231 (0.040) (67)	0.198 (0.052) (67)
	Mid	**0.053** (0.031) (33)	**0.199** (0.076) (33)
	Late	**0.130** (0.032) (41)	**0.283** (0.053) (41)
Lily P	Early	**0.267** (0.044) (199)	**0.237** (0.30) (199)
	Mid	**0.042** (0.018) (52)	**0.315** (0.101) (52)
	Late	**0.067** (0.067) (15)	**0.321** (0.204) (15)
All	Early	0.323 (0.028) (460)	0.296 (0.024) (460)
	Mid	**0.123** (0.037) (140)	**0.314** (0.055) (140)
	Late	**0.122** (0.028) (68)	**0.324** (0.062) (68)

Period of Season: Early = 4/1-6/10, Mid = 6/11-8/22, and Late = 8/23-10/31
Bolded values are statistically significant ($p \leq 0.05$)

Figure 1 provides a graphic representation of the same data, and clearly illustrates the previously described results. The three waters with viable data show interesting seasonal patterns for both trout species. Brook trout typically exhibit their highest catch rates during the early season, followed by a decline in the mid summer period, and a slight improvement in the fall on two of the waters. In comparison, rainbow trout generally have their lowest catch rates early in the season followed by subsequently higher catch rates as the season progresses.

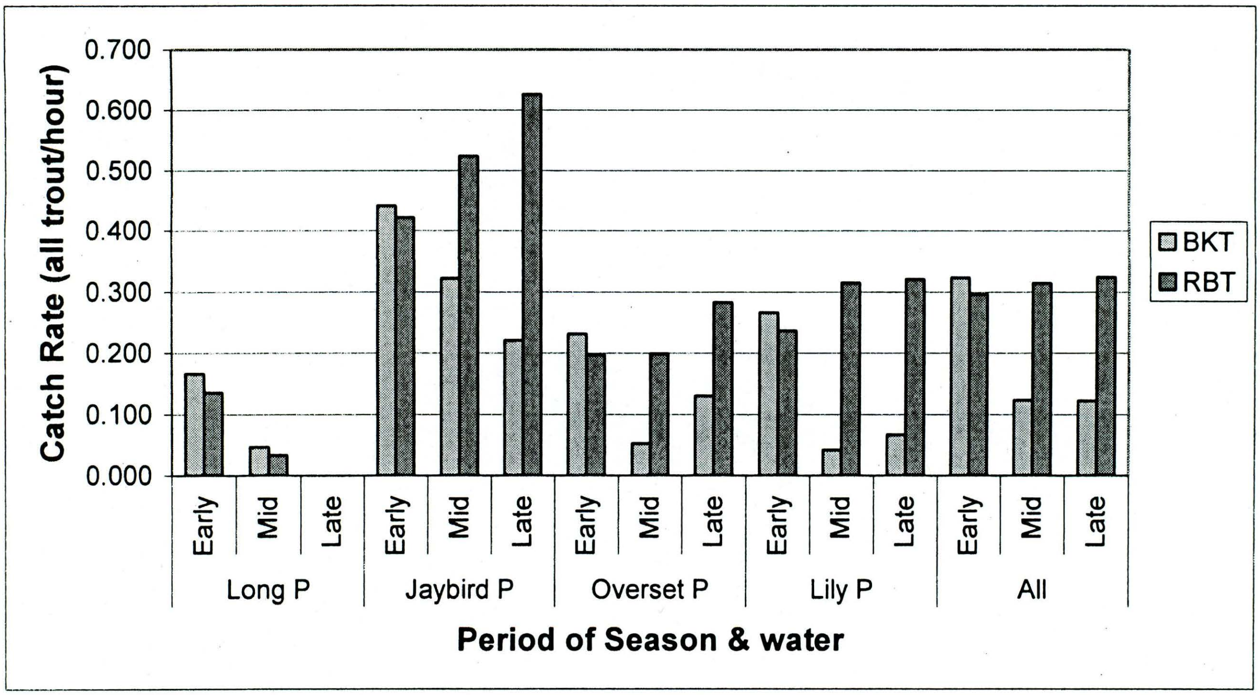

Figure 1. Mean angler catch rates (all/hour) by period of season and water, 2001-2006).

<u>Size & Growth</u>

A complete summary of length, weight, and condition data from fall sampling events is presented in Table 3. Mean lengths of brook trout ranged from 10.8 to 12.7 inches depending on the water, whereas rainbow trout varied from 12.5 to 15.5 inches. These ranges are substantially greater than the pre-stocking size advantages previously noted for rainbow trout (0.5-0.9 inches), which suggests rainbow trout grew faster, and/or had greater numbers of larger holdover rainbow trout represented in the samples. Pooling data across all ponds yielded a mean length of 11.9 and 14.6 inches for brook trout and rainbow trout, respectively. In addition, mean length data from voluntary angler surveys were similar to our netting results (Appendix E). Mean weights varied from 0.4 to 0.8 pounds and 0.6 to 1.3 pounds for brook trout and rainbow trout, respectively. The mean weight across all study waters was 0.62 pounds for brook trout and 1.1 pounds for rainbow trout. Mean length and weight were significantly higher for rainbow trout for all waters combined, and on all individual waters with adequate sample sizes (Two-sample T-test, $p \leq 0.05$). Mean K-factors were considerably more variable than lengths and weights. Brook trout K-factors were higher than rainbow trout on two of the four study waters, and the K-factor for all waters combined was larger for brook trout (0.97) than rainbow trout (0.95). However, higher K values for brook trout were significant only on Overset Pond (Two-sample T-test, $p=0.0000$). We suspect this difference is the result of a high number of mature brook trout collected during the fall sampling events on Overset Pond versus the large percentage of immature, spring spawning rainbow trout.

Mean sizes presented above were pooled across the entire study period to attain or improve sample sizes for statistical analyses; however, this method does not illustrate changes in the fisheries from the beginning to the end of the study period. On waters exhibiting holdover potential, the size quality of the rainbow fisheries typically improved over time as more older-aged fish were represented in the fishery. For example, the mean length of rainbow trout in the 2001, 2002, 2004, and 2006 samples for Overset

Pond were 12.8, 15.0, 15.8, and 16.2 inches, respectively. A complete break down of size and condition by year is presented in Appendix G.

Table 3. Summary of trout size and condition by water, species, and age (2001-2006).

Water	Species	Age					
		Data – Mean (SD)	I+	II+	III+	IV+	Total[1]
Long P	BKT	Mean Length (in)	11.4 (0.73)	14.9 ( )			**11.5** (0.90)
		Mean Weight (lb)	0.5 (0.12)	1.1 ( )			**0.5** (0.15)
		Mean K-factor	0.90 (0.11)	0.93 ( )			**0.90** (0.11)
		N	39	1			40
	RBT	Mean Length (in)	12.8 (0.92)	16.7 (0.81)			**13.6** (1.80)
		Mean Weight (lb)	0.8 (0.22)	1.7 (0.37)			**0.9** (0.46)
		Mean K-factor	0.97 (0.10)	1.01 (0.11)			**0.98** (0.10)
		N	21	5			26
Jaybird P	BKT	Mean Length (in)	10.7 (0.71)	12.1 ( )			**10.8** (0.75)
		Mean Weight (lb)	0.4 (0.09)	0.5 ( )			**0.4** (0.09)
		Mean K-factor	0.82 (0.07)	0.77 ( )			0.82 (0.07)
		N	24	1			25
	RBT	Mean Length (in)	12.5 (1.38)				**12.5** (1.38)
		Mean Weight (lb)	0.6 (0.25)				**0.6** (0.25)
		Mean K-factor	0.81 (0.08)				0.81 (0.08)
		N	23				23
Overset P	BKT	Mean Length (in)	12.0 (0.79)	13.3 (1.01)	15.2 (0.16)		**12.5** (1.19)
		Mean Weight (lb)	0.7 (0.16)	0.9 (0.21)	1.3 (0.17)		**0.8** (0.24)
		Mean K-factor	1.08 (0.09)	1.08 (0.07)	1.07 (0.15)		**1.08** (0.09)
		N	41	16	3		60
	RBT	Mean Length (in)	14.0 (0.87)	16.2 (1.09)	17.7 (1.33)	18.7 (0.65)	**15.5** (1.83)
		Mean Weight (lb)	0.9 (0.18)	1.5 (0.30)	1.9 (0.55)	2.1 (0.29)	**1.3** (0.48)
		Mean K-factor	0.94 (0.08)	0.96 (0.08)	0.91 (0.09)	0.87 (0.07)	**0.94** (0.08)
		N	41	29	10	5	85
Lily P[2]	BKT	Mean Length (in)	11.9 (1.25)	14.2 ( )			12.7 (1.58)
		Mean Weight (lb)	0.6 (0.13)	1.0 ( )			0.7 (0.27)
		Mean K-factor	0.93 (0.07)	0.99 ( )			0.95 (0.06)
		N	2	1			3
	RBT	Mean Length (in)	13.8 (0.81)	16.9 (1.06)	18.6 (1.78)		14.6 (1.69)
		Mean Weight (lb)	0.9 (0.19)	1.8 (0.24)	2.3 (0.78)		1.2 (0.45)
		Mean K-factor	0.99 (0.07)	1.03 (0.09)	0.97 (0.05)		1.00 (0.07)
		N	50	14	2		66
All	BKT	Mean Length (in)	11.5 (0.89)	13.4 (1.06)	15.2 (0.16)		**11.9** (1.25)
		Mean Weight (lb)	0.5 (0.18)	0.92 (0.22)	1.4 (0.17)		**0.62** (0.26)
		Mean K-factor	0.96 (0.14)	1.05 (0.10)	1.07 (0.15)		0.97 (0.14)
		N	106	19	3		131
	RBT	Mean Length (in)	13.5 (1.12)	16.4 (1.08)	17.8 (1.37)	18.7 (0.65)	**14.6** (1.98)
		Mean Weight (lb)	0.9 (0.24)	1.6 (0.31)	1.9 (0.58)	2.1 (0.29)	**1.1** (0.50)
		Mean K-factor	0.94 (0.10)	0.99 (0.09)	0.92 (0.08)	0.87 (0.07)	0.95 (0.10)
		N	135	48	12	5	200

[1] Bolded means were statistically significant between the two species (Two-sample T-test, $p \leq 0.05$)
[2] No statistical analyses performed on this water due to small sample size of BKT

Information presented thus far suggests that rainbow trout are typically providing better size quality. However, it was still unclear whether or not the longer lengths and higher weights for rainbow trout were due to better growth or simply a function of being stocked at slightly larger sizes and having a higher percentage of older aged fish present in most of the study lakes. The same data were utilized to compare incremental growth from the mean size at stocking by species, which removes the initial size advantage from the data. In addition, incremental growth data were modified to a monthly growth rate, which incorporates the number of days at large since stocking to address the fact that trout may have been sampled at different times throughout the study period (Figures 2 and 3).

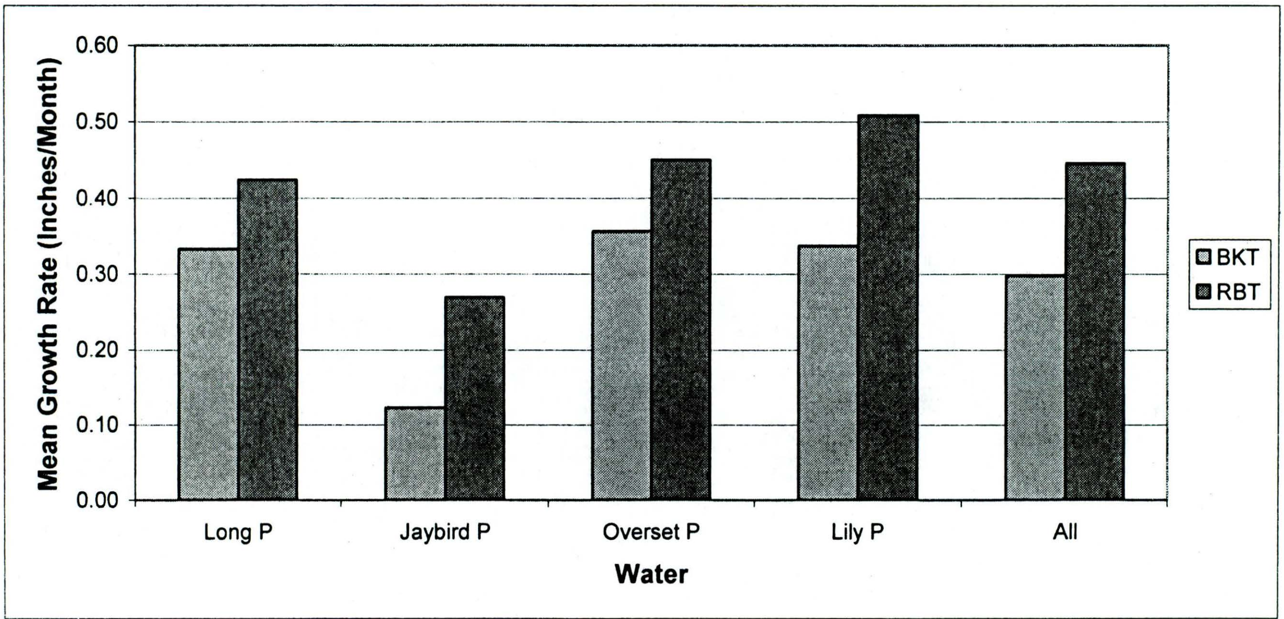

Figure 2. Mean growth rate (inches/month) by water and species, 2001-2006.

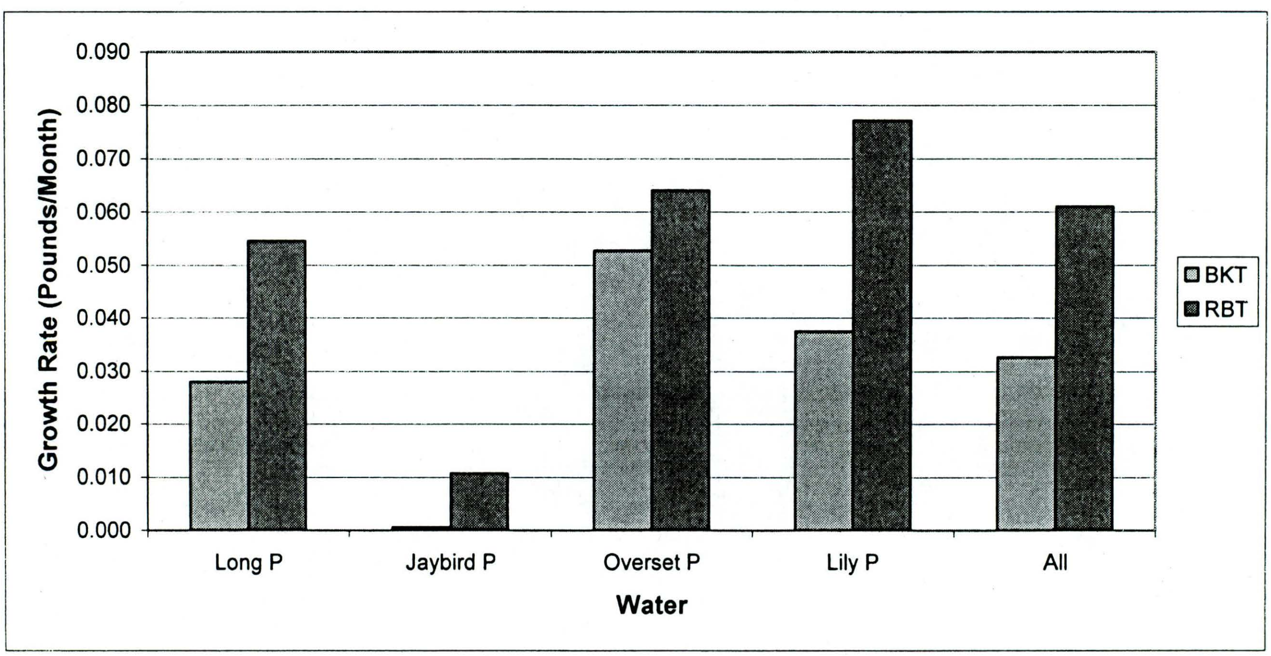

Figure 3. Mean growth rate (pounds/month) by water and species, 2001-2006.

The mean incremental growth rate for length across all waters was 0.30 and 0.45 inches/month for brook trout and rainbow trout, respectively. The difference in the mean incremental growth rate by weight for all waters combined was even more dramatic than length; 0.033 pounds/month for brook trout and 0.061 pounds/month for rainbow trout. The above differences in mean growth rates for length and weight were significantly higher for rainbow trout (Wilcoxon Rank Sum Test, 1-tailed, $p=0.0000$). Similarly, growth rates for both size parameters were statistically higher (Wilcoxon Rank Sum Test, 1-tailed, $p \leq 0.05$) for rainbow trout for individual waters with the exception of pounds/month for Jaybird Pond (Wilcoxon Rank Sum Test, 1-tailed, $p=0.175$). Additionally, both species exhibit the pattern of declining growth (inches/month) with age (Figure 4.)

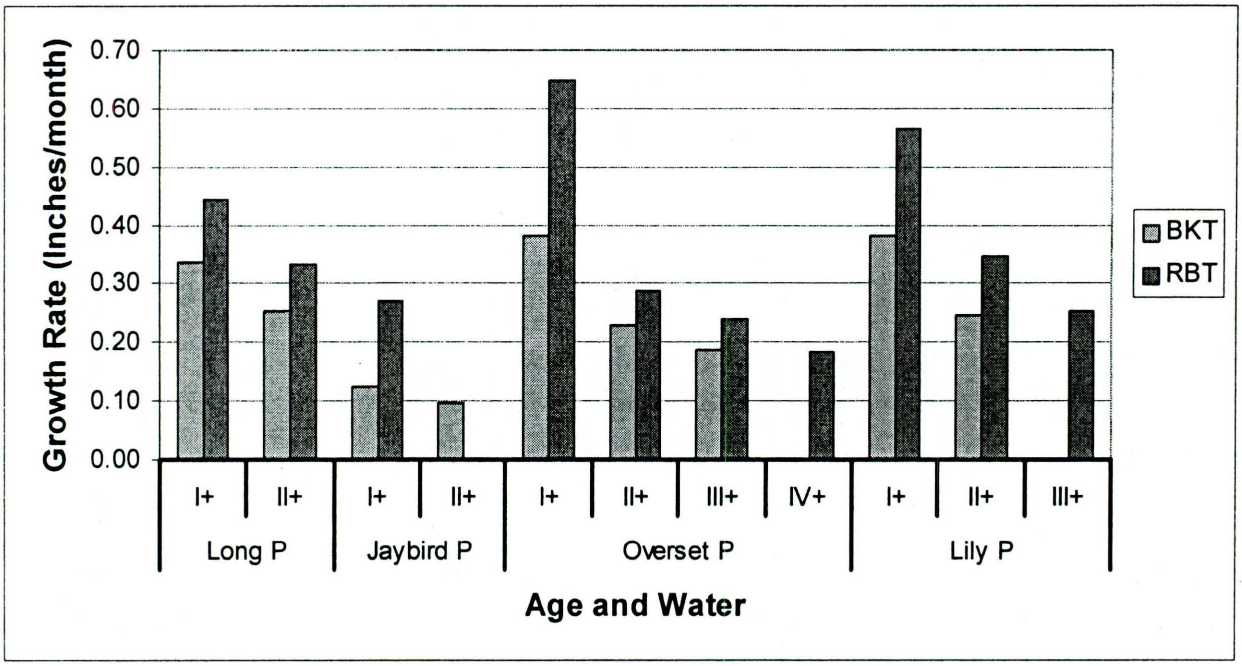

Figure 4. Mean growth rate (inches/month) by water, species, and age class (2001-2006).

Survival and Carry-over Potential

Our data suggests rainbow trout demonstrated better survival and holdover potential in three out of the four study ponds. A review of the species composition of the total trout catch of all fall sampling events shows a greater abundance of rainbow trout (Figure 5). For example, across all waters rainbow trout comprised 67.6 percent of all trout sampled, versus 32.4 percent for brook trout. Differences in the numbers of the two trout species caught were statistically significant for all waters combined and individually (Pearson's Chi-Square, $p \leq 0.05$), except for Jaybird Pond (Pearson's Chi-Square, $p=0.89$). While abundance differences could be attributed to factors other than survival (i.e. higher harvest of brook trout, sampling bias), this does not appear to be the case. As stated earlier, rainbow trout were actually harvested at a higher rate than brook trout; thus, they should actually be at a disadvantage in terms of numbers. We do not believe a strong sampling bias favoring rainbow trout existed for several reasons including the use of experimental gill nets with varying sized panels, coverage of all water depths during netting, and the ability of trout to utilize the entire water column due to cooler fall temperatures. In addition, pre-sampling in 2001 suggested gillnetting to be the least biased technique compared to other methods (i.e. trap netting, e-boating), and the samples themselves suggest lack a of sampling bias (i.e. greater abundances of brook trout caught in some years and/or on specific waters).

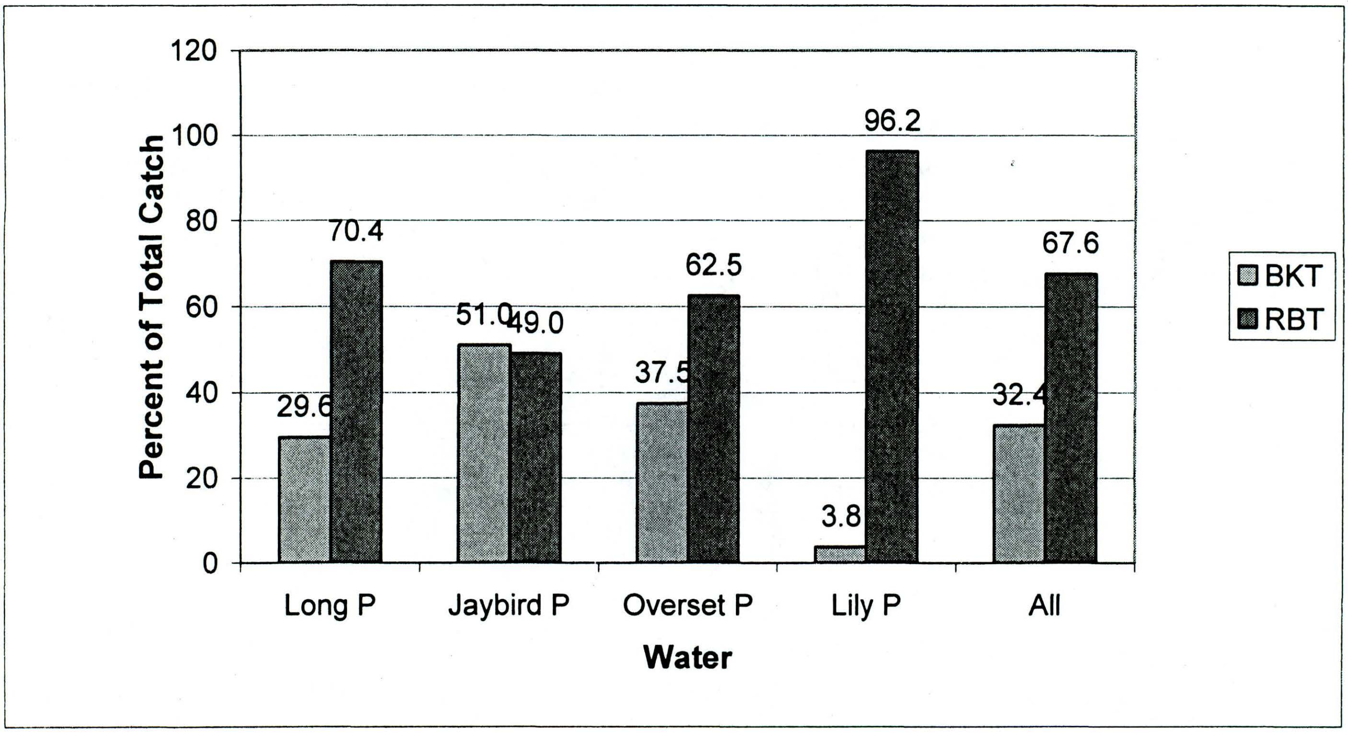

Figure 5. Species Composition of fall net samples, 2002, 2004, and 2006.

Survival estimates were calculated for each individual pond, and for all waters combined (Heinke 1913 as cited by Everhart and Youngs 1981). Due to small sample sizes, data were pooled across all three fall sampling events. Survival for brook trout and rainbow trout from all waters were 0.14 and 0.38, respectively. With the exception of Jaybird Pond, rainbow trout exhibited better survival than brook trout on three out of the four waters (Table 4).

Table 4. Annual survival by water and species (2002, 2004, and 2006).

Water	Survival	
	BKT	RBT
Long P	0.13	0.26
Jaybird P	0.04	0.00
Overset P	0.19	0.55
Lily P[1]	----	0.32
All	0.14	0.38

[1]Insufficient data, value likely close to zero due to lack of BKT caught.

A review of the age compositions for 2004 and 2006 sampling combined further illustrates the greater holdover potential of rainbow trout (Table 5). Data from 2001 and 2002 were not utilized in this analysis, because unlike - brook trout - older age classes of rainbow trout (up to the maximum observed age of IV+) would not have been represented in earlier sampling events. The data show that the number and percentage of older-aged rainbow trout were greater than brook trout on three out of the four study ponds. Across all waters, rainbow trout older than I+ comprised 55.1% of the catch versus only 10.0% for brook trout. Again, we believe sampling was not specifically biased towards rainbow trout and/or older-aged rainbow trout, and the observed differences are more likely the result of lower survival for brook trout. In addition, our data indicates lower brook trout survival is not related to harvest. Potential reasons for lower brook trout survival will be presented later in this report.

Table 5. Age class structure of trout sampled in 2004 & 2006 (combined).

Water	Species	Age				
		I+	II+	III+	IV+	Total
Long P	BKT	6 (85.7)	1(14.3)			7 (100.0)
	RBT	3 (37.5)	5 (62.5)			8 (100.0)
Jaybird P	BKT	21 (95.5)	1 (4.5)			22 (100.0)
	RBT	17 (100.0)				17 (100.0)
Overset P	BKT	18 (85.6)	2 (9.5)	1 (4.8)		21 (100.0)
	RBT	20 (35.7)	21 (37.5)	10 (17.9)	7 (12.5)	56 (100.0)
Lily P	BKT	---	---	---	---	0 (0)
	RBT	26 (61.9)	14 (33.3)	2 (4.8)		42 (100.0)
All	BKT	45 (90.0)	4 (8.0)	1 (2.0)	0 (0)	50 (100.0)
	RBT	48 (44.9)	40 (37.4)	12 (11.2)	7 (6.5)	107 (100.0)

Stomach Analyses and Diet

One of the study objectives was to examine whether or not rainbow trout utilized more of the food chain than brook trout, particularly larger diet items other than aquatic or terrestrial insects (i.e. fish, crustaceans, mollusks, amphibians). A summary of percent occurrence of general food types suggests the two species have fairly similar diets among these broad categories (Table 6), and rainbow trout do not appear to utilize non-insect food items anymore than do brook trout during the fall season. It is also interesting to note the variation in principal food items among the different waters. For example, fish and fish remains were the primary diet item for both species at Long Pond, aquatic insects at Jaybird and Overset Ponds, and plankton at Lily Pond.

Table 6. Percent occurrence of general food types by water and species (2002, 2004, and 2006).

Water	Long P		Jaybird P		Overset P		Lily P	
Species	BKT	RBT	BKT	RBT	BKT	RBT	BKT	RBT
# Stomachs Examined	8	18	25	23	30	45	2	48
% Empty	12.5	5.6	64.0	21.7	6.7	0.0	0.0	4.2
Food Type								
Aquatic insects	42.9	11.8	55.6	50.0	71.4	68.9	0.0	28.3
Insect Remains	---	---	22.2	16.7	25.0	20.0	0.0	6.5
Terrestrial Insects	28.6	17.6	0.0	11.1	32.1	11.1	---	---
Plankton	0.0	5.9	11.1	27.8	14.3	15.6	50.0	67.5
Crustacea	---	---	---	---	0.0	6.7	---	---
Amphibia	---	---	---	---	7.1	4.4	---	---
Fish/Remains	71.4	82.4	22.2	11.1	---	---	---	---
Mollusca	---	---	---	---	---	---	0.0	4.3
Spearman's rho	0.80		0.58		0.77		0.89	

A Spearman's rho correlation indicates a high degree overlap in the fall diets of the two species for most waters; however, the correlations were not significant ($p \leq 0.05$). The lack of significance in diet overlap is likely the result of small sample sizes and/or the low degrees of freedom associated with this type of diet analysis. Additionally, the broad categories presented are more likely to show overlap; yet, more specialized feeding within these categories may still occur. A more detailed look at specific items within the diet (Appendix H) appears to indicate somewhat less overlap, but a diet overlap index that utilizes percent volume or a measure of weight would be important to assess the relative value of specific food items. Our volumetric data were insufficient for such an analysis. Nevertheless, the top three to four food items by percent occurrence were typically the same for both trout species within any given water. Banded killifish were the dominant food item for both species in Long Pond, whereas plankton (predominantly large daphnia) were the primary food item in Lily Pond. Although the principal food items in Jaybird and Overset Ponds were aquatic insects for both species, the insects consumed were different. Trout in Jaybird Pond ate predominantly backswimmers/water boatman and caddis nymphs versus damselfly nymphs and amphipods at Overset Pond.

Even though the limited diet data do not suggest that rainbow trout utilize a broader spectrum of the food chain than brook trout (particularly larger diet items), growth data presented earlier demonstrated rainbow trout grew faster than brook trout. If differences in growth are not attributed to differences in the specific diets, perhaps rainbow trout simply feed more aggressively than brook trout and/or are better "converters". Our data show brook trout typically had a higher percentage of empty stomachs than rainbow trout. Across all waters the percentage of empty stomachs for brook trout and rainbow trout were 27.7 and 6.0%, respectively (Table 6). Additionally, brook trout had lower food volumes in three out of the four ponds (Figure 6). Rainbow trout stomachs had almost double the volume of food, 6.3 ml/kg for rainbow trout and 3.6 ml/kg for brook trout for all waters combined.

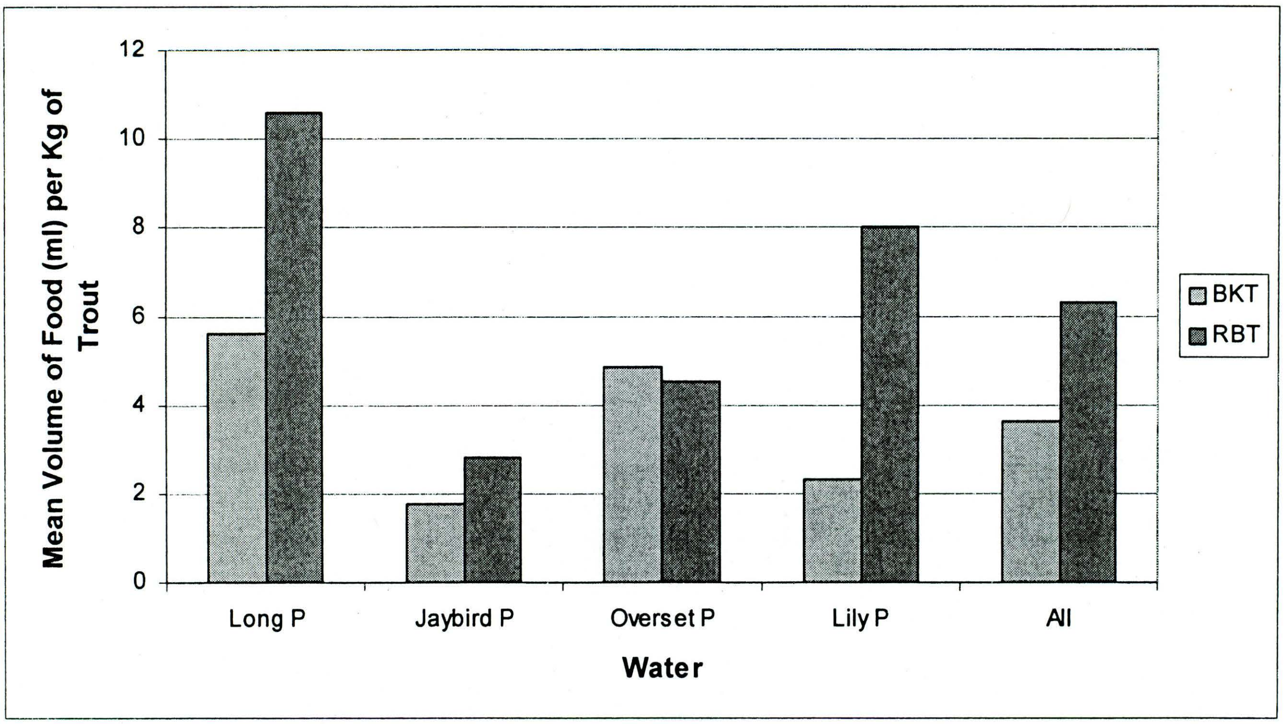

Figure 6. Mean volume of food (ml) per kilogram of trout by water and species (2002, 2004, and 2006).

Competition and Water Quality

Previous data demonstrate rainbow trout outperformed brook trout in most aspects; however, the data has not been viewed in terms of performance under various habitat limitations, particularly the level of interspecific competition and/or water quality. Although the data are limited to four study waters, some of the apparent patterns are interesting and support our field observations. The four waters were rated by their competition severity (low/moderate/high) and their summer water quality (poor/fair/good) to examine how competition and water quality might affect brook trout and rainbow trout performance. Competition severity ratings were adapted from work conducted by Bonney (2001) and a summary for the four study waters is presented in Appendix I. Regional fisheries staff determined water quality ratings based on mid-late summer conditions (Appendix J), which are typically the most limiting time period for lentic salmonid populations. Competition and water quality ratings for Jaybird and Long Ponds were nearly equal, and the performance parameters for these two ponds were averaged to reduce complexity of the graphs.

The first graph illustrates the growth rate of both species relative to competition and water quality (Figure 7.) Both species show a similar pattern of reduced growth rates as competition severity and water quality decline to moderate and poor, respectively. However, growth remarkably improves under even the heaviest competition level when water quality was better. Rainbow trout show survival rates show a similar pattern to growth rates; declining survival as competition and water quality levels decline, but they demonstrate fairly good survival under severe competition as long as water quality is not too limited (Figure 8). On the other hand, brook trout survival does not improve under high competition and fair water quality. It should be noted that an actual survival rate was not available for the high competition and fair water quality situation (Lily Pond) due to the lack of brook trout captured, and for illustration purposes it was assumed survival was essentially zero.

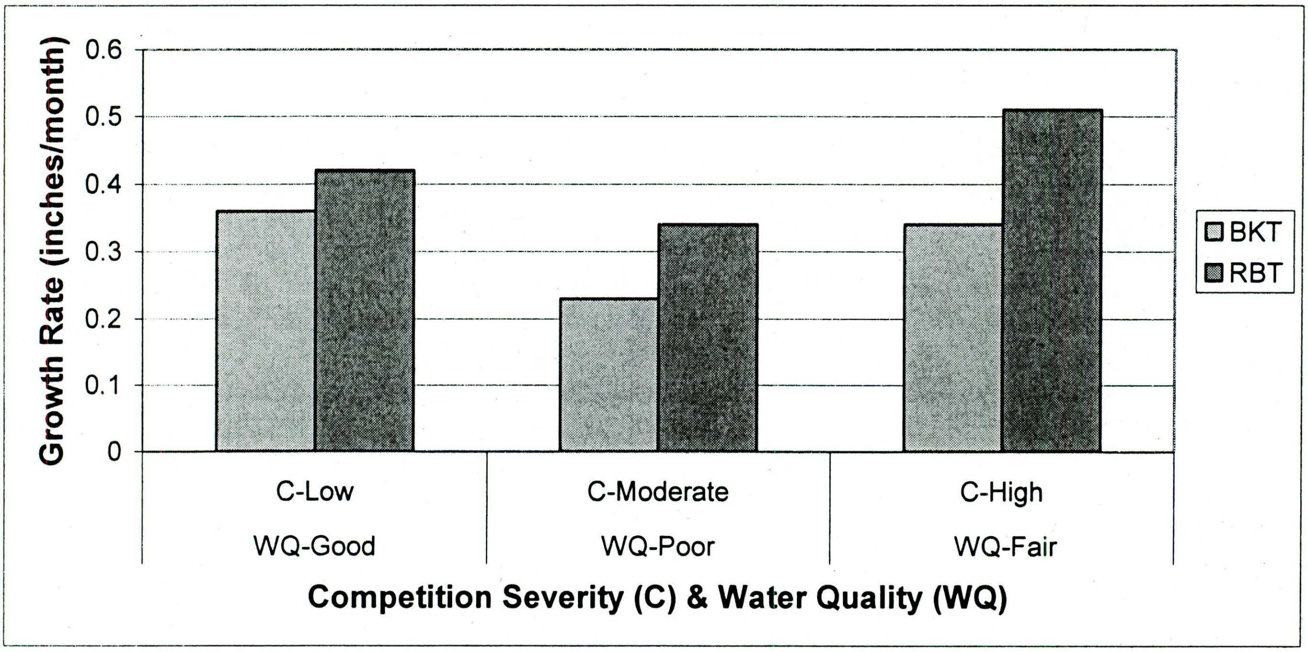

Figure 7. Mean growth rate (inches/month) relative to competition and water quality ratings by species.

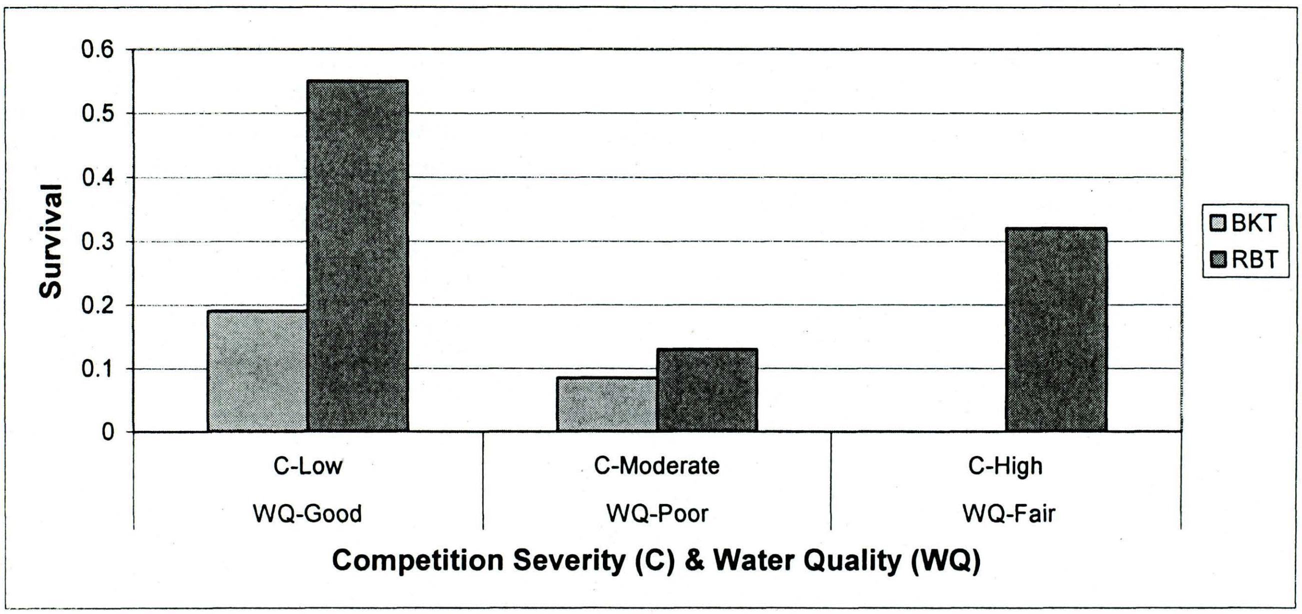

Figure 8. Trout survival relative to competition and water quality ratings by species.

Overset Pond was recently reclaimed, which provided an opportunity to examine the two species without any complications of interspecific competition from other fish species. A graph of the percent of trout sampled each year by age class shows some very dramatic changes in the two trout populations throughout the study period (Figure 9). Essentially, brook trout progressively lost older age classes until 2006 when there were no longer any holdover brook trout in the population. On the other hand, rainbow trout show the opposite pattern with increases in the number of holdover fish throughout the same time period. On the surface, this data strongly suggests potential interactions may be occurring between the two species; however, regulation changes in 2002 may also be implicated in the observed changes to the age class composition (Appendix K).

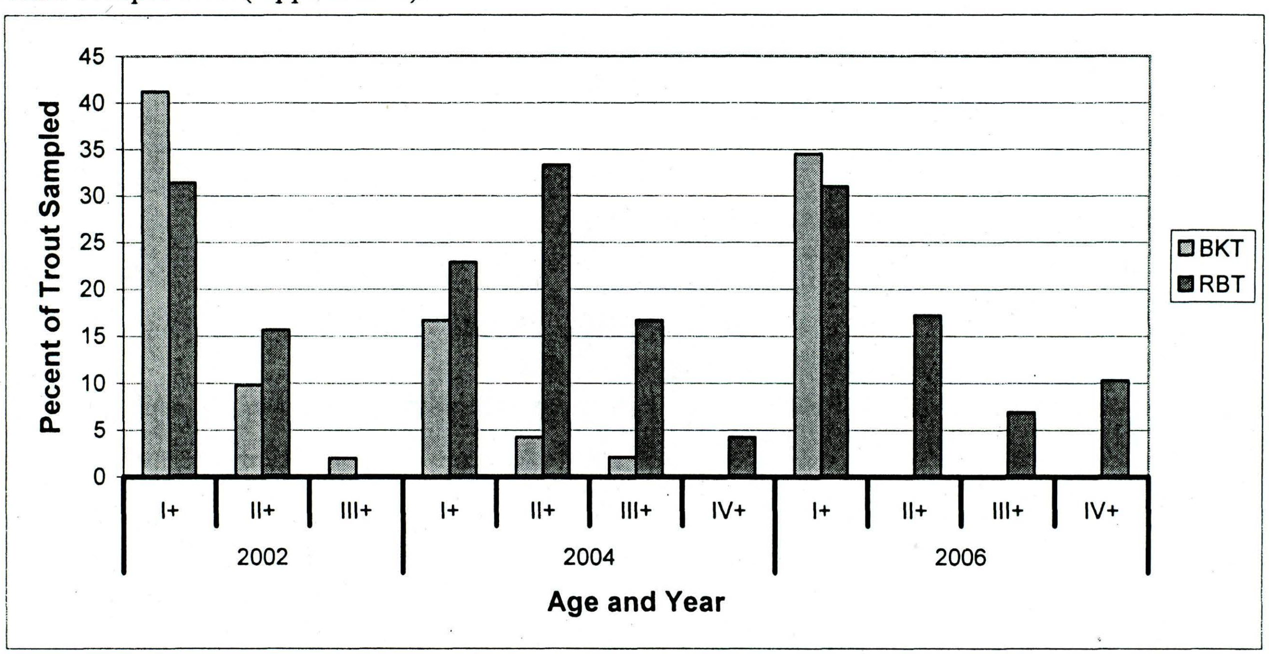

Figure 9. Frequency of trout captured during fall sampling for Overset Pond by age class, year, and species.

DISCUSSION

Angler Catch Rates, Harvest Rates, and Seasonal Availability

Rainbow trout catch rates were better than expected. Seventy one percent of the respondents in a recent survey of State fish and wildlife agencies suspected brook trout would provide better catch rates than rainbow trout (Pellerin, 2000a). In this study, Eagle Lake strain rainbow trout typically demonstrated slightly higher catch rates (all trout/hour) than Maine Hatchery strain brook trout. Although the difference in catch rates for the two species were statistically significant across all four waters combined, the difference was only 1.2 times higher for rainbow trout. In addition, catch rates between the two species were only significantly higher for rainbow trout on one of the four waters. Consequently, performance in terms of catch rates was very similar between the two species. Similar comparisons of the performance of these two species in Maine waters are limited, and comparisons of the same two strains are nonexistent. DeSandre (1974) reported similar angler catch rates for rainbow trout and brook trout in two Maine waters, Martin Pond and Carrabassett River, where equal numbers of fish were stocked and season-long clerk censuses were conducted.

Several researchers have compared the performance of these two species in other states and provinces. Baird et al. (2006) reported catch rates of stocked brook trout exceeded that of rainbow and brown trout on the South Branch of the Moose River in New York. Thorpe et al. (1947) showed similar catch and return rates for the two species on the Blackledge River in Connecticut, whereas Lemon and Elliot (1999) showed better returns for stocked rainbow trout in three out of four New York Rivers. While performance of the two species in river environments may not be comparable to lake studies, researchers have shown similar results in lake systems. Work by Fraser (1972) showed mixed results, two of four Canadian lakes stocked with both species yielded better catch rates for brook trout, while rainbow trout outperformed brook trout in the other two lakes. Other researchers have demonstrated better catch rates and returns for rainbow trout on East Fish Lake in Michigan (Alexander and Shetter 1969) and on six New York ponds (Elliot 1975).

In this study, rainbow trout were typically stocked at a slightly larger size than brook trout (0.5-0.9 inches) and rainbow trout typically demonstrated more carry-over to larger sized fish, which possibly contributed to their somewhat higher catch rates on three out of four waters. Catch rates and returns are essentially synonymous with our study design. Stockings of larger trout typically yield better returns than those of smaller sized fish (Butler and Borgeson 1965; Hansen and Stauffer 1971; Elliot 1975; Cunningham and Anderson 1992; Walters et al. 1997; Yule 2000; Baird et al. 2006). Elliot (1975) indicated a one-inch increase at size of stocking improved trout returns by 4.5%. Many researchers have attributed the higher returns with increased survival due to lower predation on larger trout. However, in this study fish predators were not present in three of the four waters, and rainbow trout still demonstrated higher catch rates in Jaybird Pond even though rainbow trout did not survive to older ages. Additionally, Larkin and Smith (1954) indicated trout caught by anglers tend be the faster growing individuals of a year class. This study showed faster growth rates for rainbow trout, suggesting catch rates documented in this report may simply be related to performance differences (i.e. feeding behavior, aggression, etc.) between the two species; however, influences associated with size at stocking and abundances of holdover trout cannot be ruled out as contributing factors.

Anecdotal evidence (angler and warden reports) and unpublished regional data for southern Maine waters suggest "put-and-take" brook trout stockings provide short-term fisheries with limited trout fishing opportunities beyond mid-June. One of the principal objectives of this study was to evaluate whether rainbow trout would provide prolonged seasonal availability. In this study, brook trout typically provided faster fishing during the early season, while rainbow trout provided better angling opportunities mid to late season. Similar results have been widely documented for these two species on rivers (Shetter and Hazzard 1940; Cooper 1952; Trembley 1943, Thorpe et al. 1947; De Sandre 1974). Conversely, Baird et al. (2006) showed higher brook trout catch rates throughout the entire season on the South Branch of the Moose River in New York. Although river studies may not be indicative of lakes, researchers have shown similar results to ours in lake systems. Shetter (1944) showed that on average, anglers caught 89.4% of the total brook trout catch in 5 Michigan Lakes during the first few weeks of the season. Similarly, Hazard and Shetter (1969) reported 82% of the brook trout angled in East Fish Lake Michigan were caught during the first month of the season, whereas only 39% of the rainbow trout catch occurred during the first month. If more brook trout are caught and harvested early in the season, it is plausible that more rainbow trout would be available later into the season. However, in this study brook trout were not of legal-size at the time of stocking and a small percentage of rainbow trout were of legal length. As a result, rainbow trout were actually harvested at statistically higher rates than brook trout, suggesting some other mechanism (i.e. rainbow trout behavior) other than fishing mortality is responsible for the observed seasonal differences in angler catch rates.

Differences in catch rates among waters in this study appeared to be strongly related to stocking rates for the two species. Miko et al. (1995) reported catch rates for catchable-sized rainbow trout were significantly higher at medium to high densities than low densities, and Shetter and Hazzard (1940) stated the total catch of trout was directly proportional to the number of fish planted in several Michigan streams. On the contrary, Butler and Burgeson (1965) indicated no relationship existed between catch per angler hour and the number of catchable trout stocked per unit of stream, and reasoned that angling effort adjusted proportionally. Similarly, Brautigam (2007) observed only a nominal increase in catch rate with a doubling of the stocking rate of catchable sized brown trout in a 900-acre Maine lake with multiple warm and coldwater fisheries. It is likely more difficult to demonstrate such relationships in large complex lake systems, and lotic environments where fish can emigrate from the system or study reach. In contrast, waters in this study were relatively small (< 25 acres in size), and a causal relationship between catch and stocking rates was evident.

<u>**Size and Growth**</u>

Overall mean lengths of brook trout and rainbow trout were 11.9 and 14.6 inches, respectively. As the fisheries matured, the mean size of rainbow trout sampled by netting actually exceeded 15 inches in three out of the four study waters by 2006. Brook trout did not show the same increase in mean lengths over time due to a lack of holdover to older age classes. A poll conducted in New Hampshire reported that the greatest number of respondents (29%) considered a good or quality-sized rainbow trout to be at least 15 or more inches in length (Sprankle 1997). It appears rainbow trout are capable of providing quality-sized trout fisheries in smaller-sized ponds with marginal conditions, whereas brook trout will typically produce a fishery where the fish are only slightly larger than their size at stocking. Although sample sizes are relatively small, both species became leaner beyond age II+. The data suggests Eagle Lake rainbow trout will rarely produce trout in excess of 3 pounds in similar waters due to higher catch and harvest rates, as well as feeding behaviors that will be discussed in more detail under Stomach Analyses and Diet.

The larger sizes reported above for rainbow trout do not necessarily indicate better growth than brook trout, because the size differences could simply be attributed to a combination of the larger size at stocking and better survival to older, larger age classes. However, a review of growth rates by water and age class, showed rainbow trout actually grew faster than brook trout. Several researchers have shown similar differences in growth rates between the two species. Elliot (1975) compared the performance of brook, brown, and rainbow trout and in six different ponds in New York, and found brook trout exhibited the poorest growth of the three trout species. Trembley (1943) reported an average monthly growth of approximately 0.15 inches/month for brook trout and 0.19 inches per month for rainbow trout in Spring Creek, Pennsylvania. Although their values are lower than observed in our study (0.30 for brook trout and 0.45 for rainbow trout), the differences in growth are quite similar. Higher growth rates for this study are probably reflective of the different habitat types (lotic versus lentic); researchers have shown poor or even negative growth of stocked trout shortly after stocking in stream systems (Baird et al. 2006, Ersbak and Hasse 1983). Alexander and Shetter (1969) showed a 1.9 times greater weight gain (pounds/month) for rainbow trout in East Fish Lake Michigan, which is similar to the 1.4 times higher weight gain observed in our study.

The observed differences in growth may be partially related to age at maturity. Many fish species including salmonids exhibit reduced growth upon reaching sexual maturity due to energy expenditures related to gamete production. A high percentage of the I+ brook trout observed during our fall sampling was mature, whereas most rainbow trout did not reach maturity until age III+. Another explanation for the observed differences in growth will be discussed in more detail in the Stomach Analyses and Diet section.

Both species exhibited declining growth rates with increasing age (Figure 4), which parallels other recent work on rainbow trout and brown trout (Pellerin 2007). Trembley (1943) showed similar results for rainbow trout and brown trout, where growth rates decreased as fish size increased. However, he noted the opposite pattern in brook trout where growth improved with increasing size groups (6-7.9, 8-9.9, and 10-12.9 inches). No explanation for this observation was reported. A pattern of declining growth with increasing age and/or size is a common characteristic of fish growth (Lagler et al. 1962; Moyle and Cech 1988).

Survival and Carry-Over Potential

Rainbow trout exhibited better survival than brook trout in three out of the four ponds examined, which is surprising considering: (1) rainbow trout were harvested at a rate 1.3 to 9.4 times higher than brook trout, and (2) most stocked brook trout were virtually protected for their first year at large due to the 12-inch minimum length limit regulation. These results are not uncommon; other researchers have documented similar results in Maine and other states (Alexander and Shetter 1969; DeSandre 1974; Elliot 1975). Alexander and Shetter (1969) reported that overwinter survival (October to April) of fall stocked brook trout and rainbow trout was 49% and 98%, respectively. Jaybird Pond was the exception, in that rainbow trout exhibited unusually poor survival. This is attributed to several factors including the exceptionally small volume of suitable summer habitat, poor winter water quality (suspect periodic winterkill), poor fish condition going into the winter, and the highest harvest difference between the two species. Despite the typically better performance of rainbow trout, annual mortality and other losses associated with both trout species were relatively high (76% for brook trout and 62% for rainbow trout), and limited the abundance of holdover trout. Additionally, low numbers of I+ trout sampled during the fall in many of the ponds suggests much of the mortality for both trout species occurs before their first winter season at large.

Mortality and/or losses of stocked trout from the study waters result from a variety of factors including: emigration, fishing mortality, predation, competition for resources (i.e. food, habitat), and/or water quality. Other than Lily Pond, it is unlikely that emigration of stocked trout was an important loss in our study waters. Three of the study waters have no substantial tributaries and the fourth (Lily Pond) has only a single small, tributary that runs through an extensive wetland system without any defined channel before entering the pond. Similarly, only Lily Pond has an active outlet. Fishing mortality is also believed to be extremely low. Although angler use data were not collected, limited pre-study data for two of the ponds indicate that use is typically relatively light (126 angler trips for Jaybird Pond in 2000 and 95 angler trips for Long Pond in 2000). Assuming use estimates are reflective of use during the study period and 10% hooking mortality, fishing would only be responsible for the loss of 14 trout from Long Pond (7 BKT and 7 RBT) and 47 trout from Jaybird Pond (19 BKT and 28 RBT) each season. Consequently, the three remaining factors (predation, competition, and water quality limitations) are most likely responsible for much of the trout mortality.

Fish and/or avian predation can be a substantial source of mortality for stocked trout (Brautigam 2006; Yule et al. 2000; Walters et al. 1997; Gaylord and Shetter 1969; Matkowski 1989). With the exception of Lily Pond, fish predation was insignificant in our study waters due in part to the species assemblages present and the size of trout stocked. Although their populations consist of few large individuals, fish predation may have occurred in Lily Pond where largemouth bass (*Micropterus salmoides*), and chain pickerel (*Esox niger*) are present. MDIFW (2005) showed substantial losses of stocked, legal-sized brook trout to largemouth bass in one pond. Similarly, Arsenault (1986) and Warner (1969) both indicated losses of stocked salmonids to chain pickerel. Brook trout survival to fall was markedly lower in Lily Pond than at any other pond, suggesting that fish predation and/or emigration may have been a substantial contributing factor for this water. Bird and mammalian predators are also commonly observed on Maine waters and include: great blue herons, mergansers, common loons, king fishers, cormorants, eagles, osprey, mink, and otter. Behavioral patterns of the two fish species may make them more vulnerable to predation or specific predators. Researchers have indicated that adult brook trout inhabit the shallow, littoral zone (Alexander and Shetter 1969); whereas rainbow trout are more likely to occupy the limnetic and/or pelagic zones (McAfee 1966a; Wurtsbaugh et al. 1975; Barwick et al. 2004). Contrary to this study, Matkowski (1989) showed lower recoveries of rainbow trout than brook trout in a bird predation study on Perch Lake in Manitoba, and concluded that rainbow trout's pelagic behavior may have made them more susceptible to the most abundant predator, common loons. On the other hand, he also suggested brook trout would probably be more vulnerable in shallower waters with extensive littoral zones and more abundant shoreline predators (i.e. great blue heron, mink, otter). We never witnessed any loon activity on any of the four ponds in this study. In our case, avian predators other than loons and mammals may have had more of an impact on brook trout than rainbow trout.

With the exception of Overset Pond, three of the four study waters had moderate to severe interpecific competition, which may have impacted trout survival. Trout populations have evolved in relatively simple aquatic communities, and their sensitivity to introductions of other fish species is well known. Magnan (1988) studied 26 small, oligotrophic lakes in Quebec where he demonstrated that the presence of one or more fish species could effectively alter zooplankton and benthic invertebrate communities, resulting in declines of native brook trout populations. In addition, it is well documented in the fisheries literature that chemical reclamation with rotenone significantly improves coldwater fisheries by removal of undesirable fish species, and our own reclamation on Overset Pond is a good example (Pellerin 2000b). While studies by Fraser (1972, 1978) indicate that both brook trout and rainbow trout are affected by competition and/or fish predation, brook trout appear to be more susceptible. The greater sensitivity of brook trout to competition may, at least in part, explain growth and survival differences observed between the two species in our study.

Research by Obrey (2005) suggests that marginal summer water quality conditions may be an important factor in the survival of stocked brook trout. Mid to late summer water quality conditions varied on the four study waters, but they all could be considered somewhat limiting for coldwater species. Habitat suitability indices suggest that rainbow trout may be a little more tolerant of marginal water quality conditions than brook trout (Raleigh 1982; Raleigh et al. 1984). Additionally, Barwick et al. (2004) found that rainbow trout in Jocassee Reservoir generally selected colder water, lower dissolved oxygen (as low as 2.9 mg/l), and deeper depths than brown trout in late summer. All three mechanisms (predation, competition, and water quality) or any combination of the three are all plausible explanations for the results observed in this study.

Lastly, Maine Hatchery Strain brook trout were used in this study due to their wide spread use in southern Maine where larger sized fish are desired for "put-and take" fisheries management programs on marginal trout waters. This domesticated strain of brook trout has exhibited poorer survival and holdover when compared against "wild" brook trout strains and their crosses (Bonney 2001; Obrey 2005). Although previous plantings of wild strains failed to produce any noticeable improvements in survival or holdover in three southern Maine waters including one of the current study waters (Jaybird Pond), future evaluations of rainbow trout against Kennebago strain brook trout may be warranted.

Stomach Analyses and Diet

Stomach analysis data should be viewed with some degree of caution due to the limitations of the data including: small sample sizes on some waters, limited seasonal sampling (fall only), lack of good volumetric information due to often immeasurable volumes of contents, and general identification of the food items. Nonetheless, the data provides some insight into the fall diets of the two species.

Not surprisingly, our data suggests fairly similar fall diets for brook trout and rainbow trout in each of the four study waters. Fraser (1978) indicated very similar diets between these two species in a more comprehensive, year-round diet study on Little Minnow Lake, Ontario. On the contrary, Wurtsbaugh et al. (1975) indicated that adult brook trout diets differed considerably from rainbow trout in Castle Lake, California due to spatial separation between the two species. The apparent overlap or similarities in trout diets found in this study do not necessarily indicate interspecific competition between the two trout species, because food resources may not be limited (Bowen in Nielsen and Johnson 1983). Other than Jaybird Pond, growth rates and fish condition of both species remained relatively high throughout the study period and food resources may not have been limiting. Isely and Kempton (2000) conducted co-stocking experiments with young-of-the-year trout. They found brook trout grew better than rainbow trout alone, but rainbow trout grew better than brook trout when stocked together. They also reported rainbow trout grew better than brook trout in co-stocking trials where food was fed in excess and suggest that, despite the lack of limiting food resources, there appeared to be some unobserved behavioral interactions, which allowed rainbow trout to compete more effectively. These results may partially explain the better growth rates observed for rainbow trout in our study.

Additionally, differences in growth may simply be a reflection of more aggressive feeding behavior by rainbow trout. As presented earlier, rainbow trout had lower percentages of empty stomachs and typically higher mean volumes of food in their stomachs relative to their body size. Alexander and Gowing (1976) found the mean quantity (volume) of food per stomach had a significant direct relationship with growth, which was irrespective of trout species, habitat type (lotic/lentic), origin (wild/hatchery), and age. They further stated, food quantity and not quality is the most important factor in determining trout growth. On the other hand, the higher percentage of empty stomachs and lower quantities of food observed in brook trout might be the result of reduced feeding activity associated with fall spawning behavior. Thus, it is uncertain if our diet data is representative of year-round feeding behavior for the two trout species.

Our limited diet data do not suggest that rainbow trout utilize a broader spectrum of the food chain than brook trout, particularly larger diet items (i.e. fish, amphibians, crustaceans, etc.) Interestingly, Eagle Lake Strain rainbow trout appear reluctant to switch to piscsivory. Several studies indicate forage fish may (Leonard and Leonard 1946; Alexander and Gowing 1976) or may not (Hubert and Gipson 1994; Hadix and Buddy 2005) be an important part of the rainbow trout diet, which suggests strain and/or lake-specific influences could play an important role in dietary preferences for this species. Although McAfee (1966b) reported Eagle Lake Strain rainbow trout feed extensively on Tui Chub (*Siphateles bicolor*) in Eagle Lake, California, several other researchers describe the strain as marginally piscivorous (Hubert and Gipson 1994; Belford 1999; Dexter 1999). Dexter (1999) reported the strain to be largely planktivorous up to 15 inches in size, but also suggested that it becomes more piscivorous once it attained lengths in excess of 18 inches. Based on this study and an earlier study of the same strain (Pellerin 2006), Eagle Lake Strain fish appear to rarely utilize forage fish in Maine waters. The one exception was Lake George, where rainbow trout exhibited phenomenal growth by utilizing an abundant smelt population in their diet (Bolduc 2003). Abundance and availability of smaller sized forage fish may be key factors in triggering the switch to piscivory.

Competition and Water Quality

The main goal of this study was to determine whether or not rainbow trout would out perform brook trout in marginal ponds with moderate to high interspecific competition and/or summer water quality limitations. Such conditions currently limit stocking programs in southern and central Maine to short-term, "put-and-take" brook trout fisheries. Simplified illustrations showing the effects of competition and summer water quality on growth rate and survival of the two species are informative (Figure 7 and 8). Not surprisingly, both trout species exhibited declining growth rates as the level of competition increased; however, growth improved under the most severe competition when water quality was somewhat better. Improved summer water quality likely provided more trout habitat, which effectively reduced competition and interactions among the various species. Rainbow trout exhibited a similar pattern for survival, whereas brook trout did not show the same corresponding increase in survival under high rates of competition and better water quality. The data suggest that: (1) rainbow trout can produce adequate fisheries under moderate to high competition if summer water quality is not too limiting; (2) rainbow trout may be sensitive to poor summer water quality; and (3) unidentified interactions between brook trout and other species may be more limiting than direct competition for food resources. Although data from our study and some of the literature references presented in earlier parts of this paper appear to support these ideas, our sample sizes were limited in terms of the number of waters examined and in some cases the number of trout sampled. Additionally, a brook trout survival rate could not be calculated for the high competition and fair water quality situation at Lily Pond due to the lack of brook trout captured, nevertheless survival was assumed to be zero. As stated earlier this may not be the case, since brook trout may have emigrated out of the pond. However, this scenario would indicate a substantial and unexplained difference in out-migration between the two trout species.

On most of the study waters competition and/or interactions between the two trout species are masked by the other fish species present. However, brook trout and rainbow trout were the only two fish species present in Overset Pond, which provided an opportunity to examine the relative performance of the two species. As previously discussed, brook trout exhibited a consistent decline in the number of holdover fish until trout older than I+ disappeared from the fishery in 2006, while rainbow trout exhibited the opposite trend (Figure 9). Although the data appears to indicate some relatively strong competition or interactions between the two trout species, another plausible mechanism for the population changes cannot be ruled out. In 2001, regulations for Overset Pond included a two trout bag limit with a minimum length limit of 8 inches, which was changed in 2002 to 2 trout with a minimum size of 12 inches to coincide with the statewide general law minimum size limit for rainbow trout. Keeping in mind that none of the spring yearling brook trout are legal (12") at the time of stocking; the regulation change possibly protected the I+ age class and led to an increase in harvest on older age classes. Given the small numbers of holdover brook trout present, it would not take much harvest to eliminate the presence of older age classes. Changes in the brook trout age class structure from 2001 to 2002 also support the regulation-based premises (Appendix J). Unfortunately, there does not appear to be any way to determine the cause of the observed changes, and perhaps both interspecific interactions and regulation changes have contributed to the adjustments in the brook trout age class structure. Also, sample sizes of holdover brook trout were small, and caution should be employed in the interpretation of the data.

Although some interactions between the two trout species are likely, it is uncertain how and to what degree those interactions influenced the findings of this study. Unpublished regional fisheries data indicates brook trout performance was extremely poor in the other three study waters even in the absence of rainbow trout. In addition, interactions between the trout species likely works both ways, and any performance benefits observed for rainbow trout might increase in the absence of brook trout.

MANAGEMENT IMPLICATIONS

Our initial and most important reason for investigating rainbow trout performance was to explore their potential for improving angling opportunities for coldwater fish, particularly in marginal trout ponds with put-and-take stocking programs. Performance results from this study indicate rainbow trout have the potential to produce longer seasonal fishing opportunities, better size quality fisheries, and a limited number of trophy-sized ($\geq$ 18 inches) trout without sacrificing overall catch rates. However, as a trout, they still have their limitations and will only produce longer season put-and-take fisheries of only slightly larger size in waters with extremely marginal conditions. In such cases, a brook trout stocking program may yield the same returns, except over a shorter period of time. On certain marginal waters currently managed for brook trout, the replacement of put-and-take brook trout stocking programs with rainbow trout could improve angling opportunities for coldwater sport fish in Maine.

In southern Maine, brown trout are often used in conjunction with put-and-take brook trout on small to medium sized, marginal trout streams with the expectation that brook trout provide good early season catch rates, while browns provide better extended season angling opportunities. Although rainbow trout performance in streams was not investigated in this study, their pond performance and stream performance reported by Pellerin (2007) suggests they could provide similar seasonal benefits as brown trout, while providing better catch and return rates than browns. DeSandre (1974) reported that rainbow trout provided better season-long fishery opportunities than brook trout on the Carrabassett River in Maine and recommended a similar strategy. While combination stockings may add diversity and benefit existing put-and-take brook trout stocking programs on ponds, it is still uncertain how competition and interactions between the two species affects brook trout performance.

Depending on the water or year, from three to fifty nine percent (average of 19.6%) of the rainbow trout stocked during this study met or exceeded that state's minimum length general law regulation of 12 inches. If spring yearling rainbow trout are to be stocked in marginal trout waters with the intention of creating longer "put-and-take" or limited "put-grow-and-take" fisheries, the majority of stocked trout should be of legal size. The current minimum length regulation is appropriate for our large to medium sized lakes with more suitable trout habitat, but fishery managers should consider adopting special trout regulations with lower size restrictions to accommodate rainbow trout stockings on marginal waters.

Before the Department adopts a rainbow trout stocking program, all of the associated hatchery and management implications need to be considered. For example, if a brood stock were developed, additional equipment would be required to manipulate rainbow trout spawning times if a fall spawning strain is preferred. In some situations, fishery managers may need to protect spring spawning rainbow trout due to their vulnerability to anglers and poachers. If rainbow trout do not replace existing programs, then the largest obstacle to overcome will probably be associated with space constraints of our existing hatchery system.

Perhaps, the most important consequence of initiating a rainbow trout program is their potential to impact native salmonids like brook trout and Atlantic salmon. Evidence suggests that rainbow trout can have negative interactions with both species (Hearn and Kynard 1986; Fausch 1988). Presumably, rainbow trout will only have the potential to create significant, long-term impacts to native species if they establish self-sustaining populations, or if they are continually stocked over existing wild salmonid populations. Although historical evidence suggests Maine waters may not be well suited for the establishment of self-sustaining rainbow trout populations, it has occurred on a few larger river systems. Of 82 waters historically stocked in Maine, rainbow trout have only established long-term, self-sustaining populations in two systems. Both are upper reaches of larger river systems and their tributaries. Self-sustaining rainbow populations have also developed in similar habitats of other New England States.

Some biologists have suggested that the low pH of Maine's waters may contribute to unsuccessful rainbow reproduction. Perry (2006) stated poor hatching and survival of rainbow fry to the swim-up stage in New Hampshire hatcheries was related to low pH. In formal evaluations, Weiner et al. (1986) documented poor hatching and early survival of progeny from adult males and females exposed to low pHs (4.5-5.5), and concluded rainbow trout oogensis is sensitive to acidic conditions. Episodic pH events in this range are likely not uncommon in Maine systems; Johnson and Kahl (2005) documented many of these occurrences on downeast rivers. While they concluded fall was the season prone to the lowest episodic pH events, spring was characterized as having longer durations of depressed pH conditions. Timing of both fall and spring pH events may be more critical for spring spawners like rainbow trout than for some fall spawning species. In addition, Pierce (2005) has reported spring die-offs of rainbow trout in farm ponds, which he attributes to episodic pH events related to snowmelt and heavy spring rains.

Later maturation of rainbow trout may play an even larger role than water chemistry in regards to their lack of success in establishing populations from stocked fish. As reported earlier, catchable stockings in smaller to medium sized streams rarely lead to significant holdover, and in larger river systems the numbers of rainbow trout three years of age or older are generally quite limited. While rainbow trout are more likely to reach maturation age in lake systems, most stocked lake systems in Maine lack significant spawning and nursery habitat for salmonids. Additionally, predation of juvenile salmonids by warmwater species substantially reduces production in these waters.

In conclusion, I agree with Scott and Crossman's (1973) statement, "The rainbow has been one of the more successful, more appreciated, and less potentially dangerous of the many attempts to introduce a fish to areas beyond its natural range." However, despite their potential benefits and limited risks, it would be irresponsible of the Department to not seriously consider the dangers involved with introducing a non-native trout species into Maine waters. If a rainbow trout-stocking program is initiated, the Department should take precautions to minimize rainbow trout interactions with wild salmonids and to reduce potential for the establishment of self-sustaining populations. The first step in this process will be to develop a sound stocking policy for rainbow trout.

RECOMMENDATIONS

A rainbow trout stocking program would improve angling success for Maine anglers, particularly on marginal waters where native salmonid species are unable to provide satisfactory angling, and where other nonnative salmonids (i.e. brown trout) provide low returns. The following recommendations should be considered with any future rainbow trout stockings in Maine.

(1) Stocking policies or guidelines need to be developed as to when and where such stockings are appropriate. For example, guidelines may include some of the following:

- Rainbow trout should not be used to replace or augment native salmonids (i.e. brook trout, landlocked salmon) that are producing successful fisheries. For example, with the conclusion of this project Region A discontinued rainbow trout stockings on Overset Pond in favor of brook trout stocking/management.

- Due to the mixed results reported by DeSandre (1974) and the poor results observed on Jaybird Pond during this evaluation, any new rainbow trout stocking programs should be evaluated. On waters where rainbow trout perform poorly, fishery managers will have to determine if the limited primary benefits (longer seasonal availability and slightly larger size) outweigh the public's desire for brook trout (Patterson et al. 2001).

- Future stockings should largely be restricted to drainages in Regions A and B where native trout populations have already been impacted or influenced by invasive fish, development, and/or historical stockings. Within these regions, rainbow trout should be used cautiously, and certain drainages would be precluded from stocking. For example, Sebago Lake and its tributaries, as well as waters within the Crooked River drainage would be prohibited from stockings to protect an indigenous population of landlocked salmon.

- Stockings could occur in Region D drainages that currently support wild rainbow populations (i.e. the Upper Androscoggin River and the Kennebec River below Wyman Lake), and in lakes without any outlets that do not currently support native salmonids. The Dead River drainage should be excluded for now, because it is uncertain if the rainbow trout population would persist if the private hatchery closed.

- Stockings in all other regions should be severely restricted to minimize impacts on native salmonids. In these other management regions, rainbow trout should only be stocked in lakes without outlets and in waters that do not currently support native salmonids. Stockings on small coastal drainages could also be considered on a case-by-case basis.

- Rainbow trout could not be stocked in any of the listed Atlantic salmon drainages.

- New rainbow trout stockings would be subject to current internal and public review processes.

(2) Investigate and consider sterilization of stocked rainbow trout to further minimize potential risks associated with establishing self-sustaining populations. Rainbow trout eggs could be heat shocked with relative ease and low expense to create predominantly sterile fish. Historically, the use of sterile salmonids (polyploids) was largely investigated as a potential method to increase growth and survival for commercial and fishery management operations (Thorgaarg and Jazwin 1981; Galbreath and Samples 2000). Today, salmonid triploids are commonly used as a tool for meeting public demands for improved angling opportunities, while minimizing risks to native salmonids.

(3) The Eagle Lake strain performed reasonably well in small, marginal trout ponds; however, other strains may exhibit better performance characteristics. Several researchers have documented significant performance differences among different rainbow trout strains (USFWS 1979; Brauhn and Kincaid 1982; Moring 1982; Dwyer and Piper 1984; Fay and Pardue 1986; Babby and Berry 1989). Durniak et al. (1987) reported returns for Eagle Lake strain rainbow trout were moderate in comparison to other strains examined in Lake Lanier, Georgia. MDIFW should consider conducting investigations of additional rainbow trout strains.

(4) Evaluate rainbow trout stocking rates, and develop standardized stocking rate guidelines based on these and additional field evaluations.

(5) Consider acquiring our own rainbow brood stock(s) to ensure long-term success of our stocking programs. Relying on out-sourced hatchery products has created problems with some past experimental programs, and would be even more of an issue with an established program that anglers expect from year to year. Control of our own brood stock would also eliminate the risks of pathogen introductions associated with annual importations from out-of-state sources.

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APPENDICES

Appendix A. Alphabetical list of 3-letter species codes.

Species Code	Common Name	Scientific Name
BKF	Banded Killifish	*Fundulus diaphanus*
BKT	Brook Trout	*Salvelinus fontinalis*
BLC	Black Crappie	*Pomoxis nigromaculatus*
BUL	Brown Bullhead	*Ameirus nebulosus*
CMS	Common Shiner	*Luxilus cornutus*
EEL	American Eel	*Anguilla rostrata*
GLS	Golden Shiner	*Notemigonus crysoleucus*
LMB	Largemouth Bass	*Micropterus salmoides*
PKL	Chain Pickerel	*Esox niger*
PKS	Pumpkinseed Sunfish	*Lepomis gibbosus*
RBT	Rainbow Trout	*Oncorhynchus mykiss*
SLT	Rainbow Smelt	*Osmerus mordax*
WHS	White Sucker	*Catostomus commersoni*

Appendix B. Project stocking summary by water.

Water Name	Stocking Pre-Study Period	Stocking Study Period	Stocking Rate (trout/acre)
Long Pond	600-800 SY BKT	150 SY BKT 150 SY RBT	6.25
Jaybird Pond	700 FF BKT (prior BKT ev.) 5-700 FF BKT 3-400 SY BKT	150 SY BKT 150 SY RBT	21.4
Overset Pond	300 SY BKT (prior recl) 150 SY BKT 75 SY BNT	100 SY BKT 100 SY RBT	9
Lily Pond	400 SY BKT 500 FF BKT 25 FY BKT	300 SY BKT 300 SY RBT	25

Appendix C. Summary of mean length (in), weight (lb), and condition of trout at time of stocking by water and year, 2001-2006.

WATER	MEAN (SD)	YEAR											
		2001		2002		2003		2004		2005		2006	
		BKT	RBT	BKT	RBT	BKT	RBT	BKT	RBT	BKT	RBT	BKT	RBT
Long P	Length (in)	9.6 (0.7)	9.9 (1.2)	9.8 (1.1)	10.6 (1.6)	9.5 (0.8)	12.1 (1.4)	9.9 (0.7)	10.8 (1.4)	10.3 (0.9)	10.5 (1.1)	9.7 (0.8)	10.3 (1.2)
	Weight (lbs)	0.33 (0.08)	0.38 (0.15)	0.38 (0.13)	0.51 (0.29)	0.38 (0.09)	0.73 (0.32)	0.43 (0.10)	0.60 (0.23)	0.44 (0.12)	0.50 (0.18)	0.36 (0.11)	0.46 (0.18)
	K-factor	1.04 (0.10)	1.01 (0.11)	1.05 (0.14)	1.07 (0.20)	1.21 (0.19)	1.06 (0.20)	1.21 (0.10)	1.26 (0.19)	1.07 (0.09)	1.14 (0.14)	1.05 (0.11)	1.12 (0.09)
	N	30	28	30	27	30	27	29	30	29	29	30	30
Jaybird P	Length (in)	9.8 (0.8)	9.9 (1.1)	9.4 (0.8)	10.6 (1.7)	10.2 (0.5)	11.1 (1.3)	10.1 (0.6)	10.9 (0.9)	10.3 (0.96)	10.5 (1.1)	9.7 (0.8)	10.3 (1.2)
	Weight (lbs)	0.37 (0.10)	0.37 (0.15)	0.30 (0.09)	0.53 (0.25)	0.44 (0.09)	0.64 (0.23)	0.39 (0.07)	0.54 (0.19)	0.44 (0.12)	0.50 (0.18)	0.36 (0.11)	0.46 (0.18)
	K-factor	1.05 (0.09)	1.01 (0.13)	1.00 (0.12)	1.14 (0.13)	1.13 (0.09)	1.24 (0.19)	1.04 (0.09)	1.13 (0.16)	1.07 (0.09)	1.14 (0.14)	1.05 (0.11)	1.12 (0.09)
	N	30	30	30	30	29	29	30	29	29	29	30	30
Overset P	Length (in)	10.1 (0.9)	9.9 (1.3)	9.8 (1.1)	10.6 (1.6)	9.5 (0.8)	12.1 (1.4)	10.5 (0.7)	10.8 (1.4)	10.3 (0.9)	10.5 (1.1)	9.7 (0.8)	10.3 (1.2)
	Weight (lbs)	0.39 (0.12)	0.37 (0.18)	0.38 (0.13)	0.51 (0.29)	0.38 (0.09)	0.73 (0.32)	0.48 (0.09)	0.60 (0.23)	0.44 (0.12)	0.50 (0.18)	0.36 (0.11)	0.46 (0.18)
	K-factor	1.01 (0.10)	0.99 (0.12)	1.05 (0.14)	1.07 (0.20)	1.21 (0.19)	1.06 (0.20)	1.12 (0.07)	1.26 (0.19)	1.07 (0.09)	1.14 (0.14)	1.05 (0.11)	1.12 (0.09)
	N	30	30	30	27	30	27	30	30	29	29	30	30
Lily P	Length (in)	10.3 (0.6)	9..9 (1.2)	9.4 (0.8)	10.6 (1.7)	10.2 (0.5)	11.1 (1.3)	10.1 (0.6)	10.9 (0.9)	10.3 (0.96)	10.5 (1.1)	9.7 (0.8)	10.3 (1.2)
	Weight (lbs)	0.42 (0.09)	0.35 (0.14)	0.30 (0.09)	0.53 (0.25)	0.44 (0.09)	0.64 (0.23)	0.39 (0.07)	0.54 (0.19)	0.44 (0.12)	0.50 (0.18)	0.36 (0.11)	0.46 (0.18)
	K-factor	1.05 (0.13)	0.95 (0.11)	1.00 (0.12)	1.14 (0.13)	1.13 (0.09)	1.24 (0.19)	1.04 (0.09)	1.13 (0.16)	1.07 (0.09)	1.14 (0.14)	1.05 (0.11)	1.12 (0.09)
	N	30	30	30	30	29	29	30	29	29	29	30	30

All Years (2001-2006)

Water	Long P		Jaybird P		Overset P		Lily P	
Mean (SD)	**BKT**	**RBT**	**BKT**	**RBT**	**BKT**	**RBT**	**BKT**	**RBT**
Length (in)	9.8 (0.89)	10.7 (1.5)	9.9 (0.82)	10.5 (1.29)	10.0 (0.94)	10.7 (1.49)	10.0 (0.81)	10.5 (1.3)
Weight (lbs)	0.39 (0.11)	0.53 (0.25)	0.38 (0.11)	0.51 (0.21)	0.40 (0.12)	0.53 (026)	0.39 (0.11)	0.50 (0.22)
K-factor	**1.10** (0.15)	**1.11** (0.18)	1.06 (0.10)	1.13 (0.16)	**1.09** (0.14)	**1.11** (0.18)	**1.06 (0.11)**	**1.12 (0.16)**
N	178	171	178	177	179	173	178	177

Note: Non-bolded means were significantly different between the two trout species for individual waters (Two-sample T-test, $p \leq 0.05$)

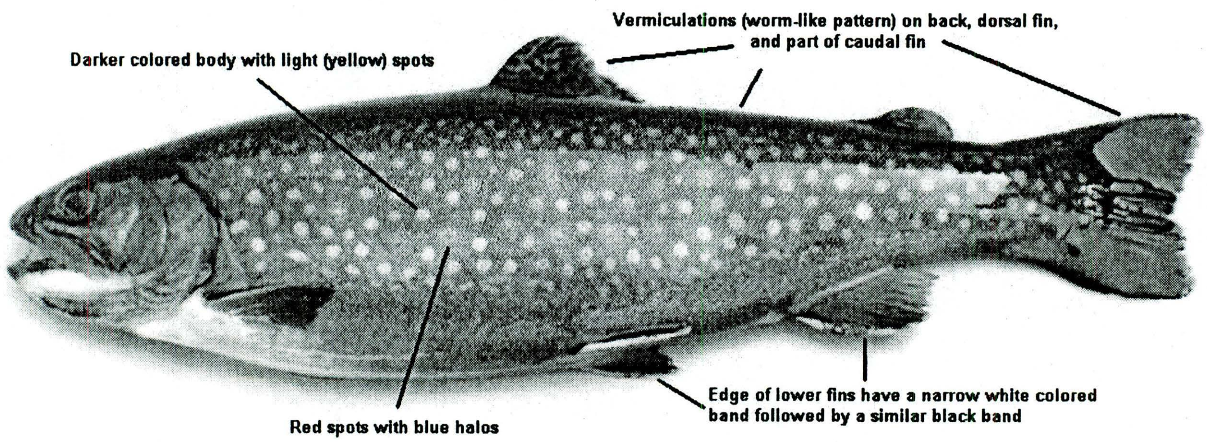
Appendix D. Voluntary box informational sign.

Maine Department of Inland Fisheries and Wildlife

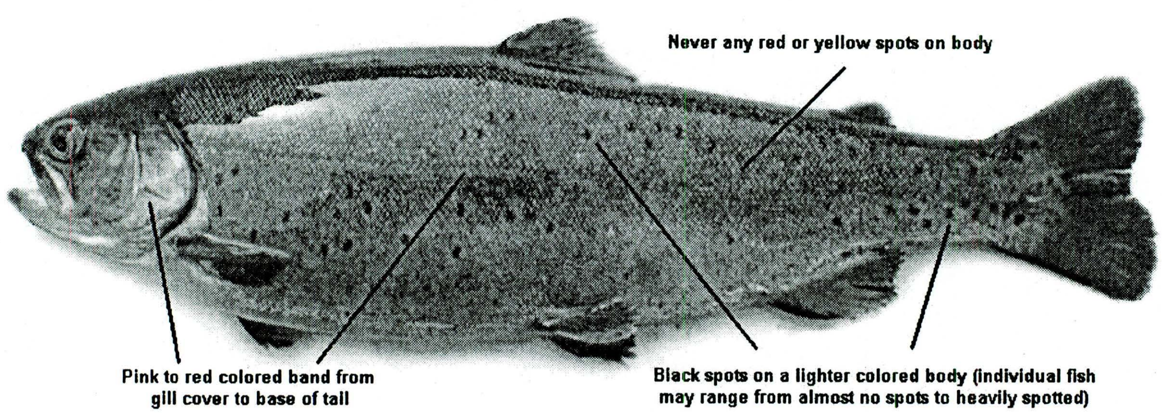
Attention Anglers - Study Water

The Maine Department of Inland Fisheries and Wildlife is conducting an experimental stocking program with rainbow trout to evaluate their relative performance against brown trout and brook trout. This particular water is being stocked with brook trout and rainbow trout, and your cooperation is required for successful evaluation. Please completely fill out a blank voluntary census card located under the lid and place into compartment. It is important to accurately identify the two different trout species and the photographs below are available for reference. Also, be on the look out for any missing fins on your fish (all stocked trout for this study have been marked). If you fish this water frequently, you may be interested in keeping a voluntary record book instead of filling out the individual cards. If so, please contact your regional fisheries office. Thanks for your time and cooperation.

Brook Trout



Rainbow Trout



Appendix E. Summary statistics for voluntary creel data by water and year(s).

Water: Long P (3084) Town: Denmark County: Oxford
Region: A Acres: 48 Principle Fisheries: BKT/RBT
Season: Open water Survey Method: Voluntary (box, book, Trip Tracks)

STATISTICS		SURVEY YEAR(S)		
Year		2001[1]	2002-2006	All
No. anglers surveyed		19	48	67
No. angler hours		60.0	125.5	185.5
Mean Party Size		1.90	1.60	1.68
Mean Trip Length		3.23	2.63	2.78
No. (%) successful anglers	BKT	3 (15.8)	3 (6.3)	6 (9.0)
	RBT	4 (21.1)	3 (6.3)	7 (10.4)
No. legals kept	BKT	3	1	4
	RBT	3	2	5
No. (%) legals released	BKT	0 (0)	2 (66.7)	2 (33.3)
	RBT	1 (25.0)	2 (50.0)	3 (37.5)
No. (%) sublegals	BKT	0 (0)	17 (85.0)	17 (73.9)
	RBT	1 (20.0)	3 (42.9)	4 (33.3)
Legals/Hour (SE)	BKT	0.113 (0.070)	0.044 (0.025)	0.045 (0.020)
	RBT	0.076 (0.052)	0.048 (0.028)	0.054 (0.023)
Kept/Hour (SE)	BKT	0.113 (0.070)	0.017 (0.017)	0.024 (0.015)
	RBT	0.076 (0.052)	0.022 (0.022)	0.028 (0.018)
All/Hour (SE)	BKT	0.113 (0.070)	0.126 (0.041)	0.106 (0.032)
	RBT	0.076 (0.052)	0.085 (0.041)	0.084 (0.032)
Hours/trout caught	BKT	8.8	7.9	9.4
	RBT	13.2	11.8	11.9
Mean Length (in) (N)	BKT	11.5 (3)	9.9 (13)	10.2 (16)
	RBT	11.9 (5)	11.5 (10)	11.7 (15)

[1] 2001 data shown separately due to different length limit restrictions between the 2 species, BKT 10 inch minimum w/ only 1 >12 inches/RBT 12 inch minimum

Appendix E (con). Summary statistics for voluntary creel data by water and year(s).

Water: Jaybird P (3178) Town: Hiram/Porter County: Oxford
Region: A Acres: 14 Principle Fisheries: BKT/RBT
Season: Open water Survey Method: Voluntary (box, book, Trip Tracks)

STATISTICS		SURVEY YEAR(S)		
Year		2001[1]	2002-2006	All
No. anglers surveyed		47	268	315
No. angler hours		112.6	639.1	751.7
Mean Party Size		1.42	1.43	1.43
Mean Trip Length		2.37	2.44	2.43
No. (%) successful anglers	BKT	19 (40.4)	37 (13.8)	56 (17.8)
	RBT	10 (21.3)	63 (23.5)	73 (23.2)
No. legals kept	BKT	1	12	13
	RBT	3	29	32
No. (%) legals released	BKT	33 (97.1)	40 (76.9)	73 (84.9)
	RBT	20 (87.0)	56 (65.9)	76 (70.4)
No. (%) sublegals	BKT	3 (8.1)	160 (75.5)	163 (65.5)
	RBT	40 (63.5)	124 (59.3)	164 (60.3)
Legals/Hour (SE)	BKT	0.292 (0.071)	0.088 (0.018)	0.118 (0.019)
	RBT	0.145 (0.068)	0.174 (0.026)	0.170 (0.024)
Kept/Hour (SE)	BKT	0.040 (0.040)	0.018 (0.007)	0.021 (0.008)
	RBT	0.025 (0.020)	0.046 (0.010)	0.043 (0.009)
All/Hour (SE)	BKT	0.368 (0.087)	0.419 (0.052)	0.411 (0.046)
	RBT	0.547 (0.113)	0.431 (0.048)	0.448 (0.044)
Hours/trout caught	BKT	2.7	2.4	2.4
	RBT	1.8	2.3	2.2
Mean Length (in) (N)	BKT	11.2 (37)	10.2 (210)	10.3 (237)
	RBT	10.4 (63)	11.1 (215)	10.9 (278)

[1] 2001 data shown separately due to different length limit restrictions between the 2 species, BKT 8 inch minimum /RBT 12 inch minimum

Appendix E (con). Summary statistics for voluntary creel data by water and year(s).

Water: Overset (3482) Town: Greenwood County: Oxford
Region: A Acres: 22 Principle Fisheries: BKT/RBT
Season: Open water Survey Method: Voluntary (box, book, Trip Tracks)

STATISTICS		SURVEY YEAR(S)		
Year		2001[1]	2002-2006	All
No. anglers surveyed		25	212	237
No. angler hours		98.5	727.6	826.1
Mean Party Size		1.79	1.67	1.68
Mean Trip Length		3.9	3.46	3.5
No. (%) successful anglers	BKT RBT	14 (56.0) 2 (8.0)	41 (19.3) 77 (36.3)	55 (23.2) 79 (33.3)
No. legals kept	BKT RBT	9 1	29 39	38 40
No. (%) legals released	BKT RBT	16 (64.0) 1 (50.0)	22 (43.1) 80 (67.2)	38 (50.0) 81 (66.9)
No. (%) sublegals	BKT RBT	0 (0.0) 2 (50.0)	52 (50.5) 12 (9.2)	52 (40.6) 14 (10.4)
Legals/Hour (SE)	BKT RBT	0.318 (0.112) 0.031 (0.034)	0.086 (0.016) 0.230 (0.037)	0.109 (0.019) 0.211 (0.034)
Kept/Hour (SE)	BKT RBT	0.140 (0.073) 0.008 (0.008)	0.036 (0.009) 0.065 (0.012)	0.046 (0.011) 0.059 (0.011)
All/Hour (SE)	BKT RBT	0.318 (0.112) 0.047 (0.025)	0.143 (0.022) 0.242 (0.037)	0.160 (0.023) 0.223 (0.034)
Hours/trout caught	BKT RBT	3.1 21.3	7.0 4.1	6.3 4.5
Mean Length (in) (N)	BKT RBT	11.6 (25) 11.5 (4)	11.9 (82) 14.3 (136)	11.8 (107) 14.2 (140)

[1] 2001 data shown separately due to different length limit restrictions between the 2 species, BKT 8 inch minimum /RBT 12 inch minimum

Appendix E (con). Summary statistics for voluntary creel data by water and year(s).

Water: Lily (3702) Town: New Gloucester County: Cumberland
Region: A Acres: 24 Principle Fisheries: BKT/RBT
Season: Open water Survey Method: Voluntary (box, book, Trip Tracks)

STATISTICS		SURVEY YEAR(S)		
Year		2001[1]	2002-2006	All
No. anglers surveyed		68	336	404
No. angler hours		185.9	853.8	1039.8
Mean Party Size		1.79	1.47	1.5
Mean Trip Length		2.8	2.5	2.5
No. (%) successful anglers	BKT	13 (19.1)	27 (8.0)	40 (9.9)
	RBT	11 (16.2)	83 (24.7)	94 (23.3)
No. legals kept	BKT	8	7	15
	RBT	2	55	57
No. (%) legals released	BKT	12 (60.0)	38 (84.4)	50 (76.9)
	RBT	14 (87.5)	72 (56.7)	86 (60.1)
No. (%) sublegals	BKT	3 (13.0)	84 (65.1)	87 (57.2)
	RBT	7 (30.4)	22 (14.8)	29 (16.9)
Legals/Hour (SE)	BKT	0.128 (0.051)	0.081 (0.022)	0.088 (0.020)
	RBT	0.174 (0.085)	0.234 (0.032)	0.225 (0.030)
Kept/Hour (SE)	BKT	0.039 (0.016)	0.011 (0.005)	0.015 (0.005)
	RBT	0.009 (0.006)	0.103 (0.019)	0.090 (0.016)
All/Hour (SE)	BKT	0.152 (0.056)	0.221 (0.038)	0.211 (0.034)
	RBT	0.208 (0.086)	0.265 (0.034)	0.257 (0.032)
Hours/trout caught	BKT	6.6	4.5	4.7
	RBT	4.8	3.8	3.9
Mean Length (in) (N)	BKT	11.3 (24)	10.5 (99)	10.7 (123)
	RBT	12.7 (23)	15.0 (155)	14.7 (178)

[1] 2001 data shown separately due to different length limit restrictions between the 2 species, BKT 10 inch minimum w/ only 1 >12 inches /RBT 12 inch minimum

Appendix E (con). Summary statistics for voluntary creel data by water and year(s).

Water: All Study Waters (combined) Town:____ County: ______ Region: A Acres:__
Principle Fisheries: BKT/RBT
Season: Open water Survey Method: Voluntary (box, book, Trip Tracks)

STATISTICS		SURVEY YEAR(S)		
Year		2001[1]	2002-2006	All
No. anglers surveyed		159	864	1023
No. angler hours		457	2346.1	2803.1
Mean Party Size		1.67	1.51	1.53
Mean Trip Length		2.85	2.70	2.72
No. (%) successful anglers	BKT	49	108	157
	RBT	27	226	253
No. legals kept	BKT	21	49	70
	RBT	9	125	134
No. (%) legals released	BKT	61	102	163
	RBT	36	210	246
No. (%) sublegals	BKT	6	313	319
	RBT	50	161	211
Legals/Hour (SE)	BKT	0.204 (0.037)	0.083 (0.011)	0.100 (0.011)
	RBT	0.132 (0.042)	0.204 (0.018)	0.194 (0.016)
Kept/Hour (SE)	BKT	0.055 (0.019)	0.019 (0.004)	0.024 (0.004)
	RBT	0.018 (0.008)	0.072 (0.009)	0.064 (0.008)
All/Hour (SE)	BKT	0.240 (0.042)	0.264 (0.024)	0.260 (0.021)
	RBT	0.289 (0.056)	0.305 (0.023)	0.303 (0.021)
Hours/trout caught	BKT	4.2	3.8	3.8
	RBT	3.5	3.3	3.3
Mean Length (in) (N)	BKT	11.4 (89)	10.6 (404)	10.7 (493)
	RBT	11.1 (95)	13.1 (516)	12.8 (611)

[1] 2001 data shown separately due to different length limit restrictions between the 2 species, BKT 10 inch minimum w/ only 1 >12 inches /RBT 12 inch minimum

Appendix F. Percentage of Trout Stocked at Legal Size (12 inches) by Water and Year.

Water	Species	Year(s)						
		2001	2002	2003	2004	2005	2006	All
Long P	RBT	3.6	22.2	59.3	30.0	6.9	13.3	22.2
	BKT	0	0	0	0	0	0	0
Jaybird P	RBT	3.3	33.3	37.9	6.9	6.9	13.3	16.9
	BKT	0	0	0	0	0	0	0
Overset P	RBT	6.7	22.2	59.3	30.0	6.9	13.3	22.5
	BKT	0	0	0	0	0	0	0
Lily P	RBT	3.3	33.3	37.9	6.9	6.9	13.3	16.9
	BKT	0	0	0	0	0	0	0
All (Mean of the Means)	RBT	4.2	27.8	48.6	18.5	6.9	13.3	19.6
	BKT	0	0	0	0	0	0	0

Appendix G. Mean size and condition of fall sampled trout by water, year, and species.

Water	Mean (SD)	Year							
		2001		2002		2004		2006	
		BKT	RBT	BKT	RBT	BKT	RBT	BKT	RBT
Long P	Length (in)	11.6 (90)	12.2 (0.48)	11.0 ( )	13.0 (0.91)	10.9 ( )	14.5 (1.59)	11.7 (1.68)	16.4 (1.22)
	Weight (lbs)	0.52 (0.16)	0.63 (0.10)	0.45 ( )	0.77 (0.20)	0.51 ( )	1.16 (0.54)	0.56 (0.28)	1.22 (1.64)
	K-factor	0.90 (0.11)	0.96 (0.07)	0.93 ( )	0.96 (0.11)	1.07 ( )	1.00 (0.13)	0.91 (0.09)	1.02 (0.14)
	N	34	8	1	10	1	3	6	5
Jaybird P	Length (in)			11.2 (0.51)	12.8 (1.99)	10.5 (0.63)	12.8 (1.01)	11.2 (0.81)	11.3 (0.71)
	Weight (lbs)			0.45 (0.08)	0.68 (0.39)	0.34 (0.07)	0.62 (0.17)	0.42 (0.09)	0.41 (0.10)
	K-factor			0.89 (0.13)	0.84 (0.10)	0.81 (0.06)	0.80 (0.08)	0.81 (0.05)	0.77 (0.05)
	N			3	13	14	13	8	4
Overset P	Length (in)	12.9 (1.04)	12.8 ((0.97)	12.7 (1.35)	15.0 (1.37)	12.2 (1.08)	15.8 (1.52)	11.8 (0.63)	16.2 (2.32
	Weight (lbs)	0.84 (0.19)	0.70 (0.14)	0.82 (0.30)	1.18 (0.35)	0.71 (0.22)	1.33 (0.36)	0.69 (0.12)	1.56 (0.67)
	K-factor	1.06 (0.07)	0.92 (0.05)	1.07 (0.09)	0.95 (0.07)	1.05 (0.07)	0.93 (0.10)	1.17 (0.06)	0.96 (0.07)
	N	12	5	27	24	11	37	10	19
Lily P	Length (in)	12.8 (0)	13.5 (0.93)	12.6 (2.23)	14.1 (1.18)		14.8 (1.70)		15.2 (1.82)
	Weight (lbs)	0.66 (0)	0.84 (0.22)	0.74 (0.38)	1.10 (0.23)		1.17 (0.41)		1.35 (0.51)
	K-factor	0.87 (0)	0.94 (0.07)	0.98 (0)	1.06 (0.04)		0.97 (0.05)		1.02 (0.07)
	N	2	16	2	8		12		30

Appendix H. Percent Occurrence of specific food items by water and species (2002,2004, and 2006).

Water	Long P		Jaybird P		Overset P		Lily P	
Species	BKT	RBT	BKT	RBT	BKT	RBT	BKT	RBT
Diet Item								
Damselfly (nymph)	---	---	---	---	39.3	64.4	---	---
Dragonfly (nymph)	---	---	---	---	17.9	15.6	---	---
Caddis (nymph)	---	---	22.2	27.8	10.7	11.1	0.0	19.6
Mayfly (nymph)	14.3	0.0	---	---	---	---	---	---
Amphipod	---	---	---	---	25.0	42.2	0.0	37.0
Boatman/Backswimmer	---	---	33.3	27.8	10.7	13.3	---	---
Horsehair worm	0.0	5.9	---	---	---	---	---	---
Chironimid (nymph)	---	---	---	---	7.1	4.4	---	---
Bee/Wasps	0.0	5.9	---	---	---	---	---	---
Aquatic Beetle	28.6	5.8	11.1	0.0	3.6	11.1	0.0	8.7
Terrestrial Beetle	14.3	0.0	---	---	---	---	---	---
Lady bug	14.3	11.8	0.0	5.6	3.6	6.7	---	---
Squash bug	14.3	17.6	---	---	0.0	2.2	---	---
Stink bug	---	---	---	---	0.0	2.2	---	---
Thorn bug	---	---	---	---	3.6	2.0	---	---
Spider	---	---	0.0	5.6	25.0	6.7	---	---
House Fly	---	---	---	---	3.6	2.2	---	---
Moth	---	---	---	---	0.0	2.2	---	---
Grasshopper	---	---	---	---	0.0	6.7	---	---
Plankton	0.0	5.9	11.1	27.8	14.3	15.6	50.0	43.5
Crayfish	---	---	---	---	0.0	6.7	---	---
Frog	---	---	---	---	3.6	2.2	---	---
Salamander	---	---	---	---	3.6	2.2	---	---
Banded Killifish	42.9	52.9	---	---	---	---	---	---
Rainbow smelt	28.6	0.0	---	---	---	---	---	---
Pumpkinseed sunfish	---	---	0.0	5.6	---	---	---	---
Golden shiner	---	---	0.0	5.6	---	---	---	---
Fish remains	42.9	47.1	22.2	5.6	---	---	---	---
Fish egg	---	---	---	---	---	---	50.0	0.0
Crayfish	---	---	---	---	---	---	---	
Clams	---	---	---	---	---	---	0.0	4.3
Snails	0.0	5.9	---	---	---	---	---	---

Appendix I. Competing fish species (excluding trout) present in study ponds and competition severity rating (adapted from Bonney 2002).

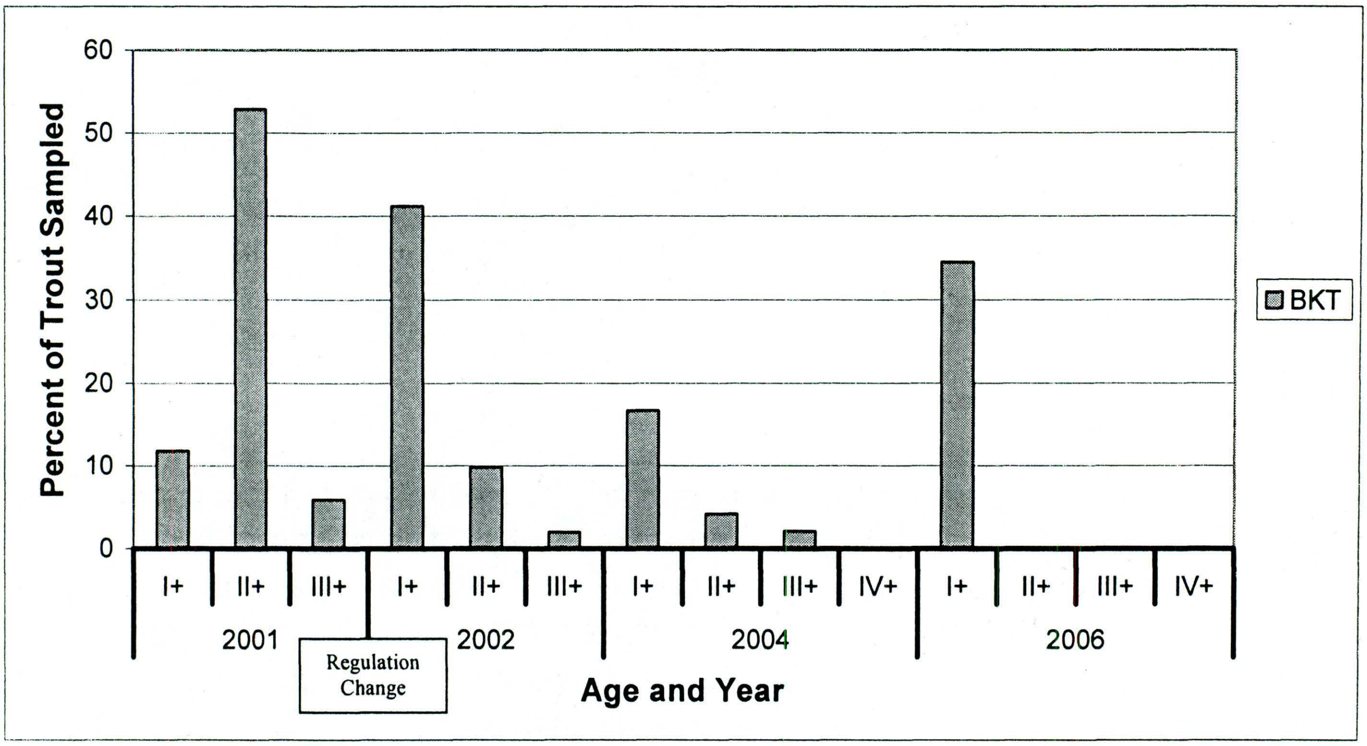
Water	EEL	LMB	PKL	GLS	WHS	BLC	PKS	BUL	BKF	SLT	All	0-10 Scale	Category
Overset P											0	0	Low
Jaybird P[1]				5	*		6	9			20	4.2	Moderate
Long P				5				9	3	6	23	4.9	Moderate
Lily P[1,2]	6	9	10	5	*	8		9			47	10	High

[1] WHS present, but due to their low abundance were not included as competitors.
[2]No concensus rating was available for BLC, rated by author based on ratings available for other species.

Appendix J. Select summer water quality values by water.

Water	Date	Depth (ft)	Temp (°F)	D.O. (ppm)	pH	Total Alk.
Long P	09/22/98	0	71	8.3	6.5	4.0
		5	71	8.4		
		10	70	8.3		
		15	70	7.7		
		18	70	5.6		
		20	70	4.7		
Jaybird P	08/02/95	0	80	7.8		
		6	79	7.8		
		10	73	7.0		
		12	70	5.4		
		14	64	3.6		
		20	53	0.4		
Overset P	07/31/96	0	71	8.0	6.0	2.0
		5	71	8.3		
		10	68	8.0		
		15	61	6.7		
		20	49	4.0		
		25	45	2.1		
Lily P	09/01/95	0	70	8.4	6.5	2.0
		6	70	8.6		
		10	68	7.9		
		12	65	5.4		
		14	61	2.0		
		20	48	0.2		

Appendix K. Age class structure changes of brook trout over time for Overset Pond (2001-2006).



Note: regulations prior to 2002 – bag limit of 2 trout with a minimum length of 8 inches; in 2002 regulations changed to a minimum length of 12 inches to match statewide general law for rainbow trout.

COOPERATIVE

STATE FEDERAL

PROJECT

This report has been funded in part by the Federal Aid in Sport Fish Restoration Program. This is a cooperative effort involving federal and state government agencies. The program is designed to increase sport fishing and boating opportunities through the wise investment of anglers' and boaters' tax dollars in state sport fishery projects. This program which was funded in 1950 was named the Dingell-Johnson Act in recognition of the congressmen who spearheaded this effort. In 1984 this act was amended through the Wallop-Breaux Amendment (also named for the congressional sponsors) and provided a threefold increase in Federal monies for sportfish restoration, aquatic education and motorboat access.

The Program is an outstanding example of a "user pays-user benefits", or "user fee" program. In this case, anglers and boaters are the users. Briefly, anglers and boaters are responsible for payment of fishing tackle excise taxes, motorboat fuel taxes, and import duties on tackle and boats. These monies are collected by the sport fishing industry, deposited in the Department of Treasury, and are allocated the year following collection to state fishery agencies for sport fisheries and boating access projects. Generally, each project must be evaluated and approved by the U.S. Fish and Wildlife Service (USFWS). The benefits provided by these projects to users complete the cycle between "user pays — user benefits".

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